

Appendix 8 Structural Analysis

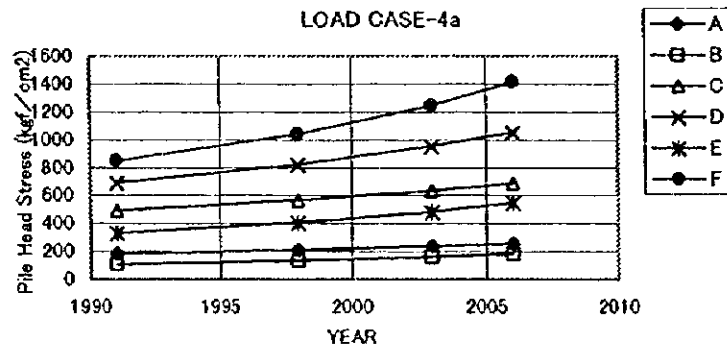
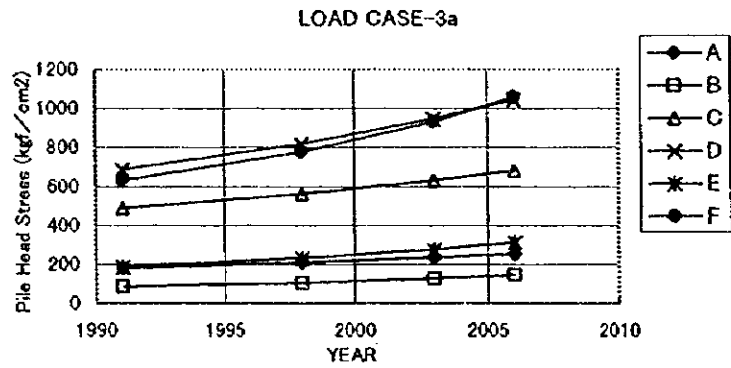
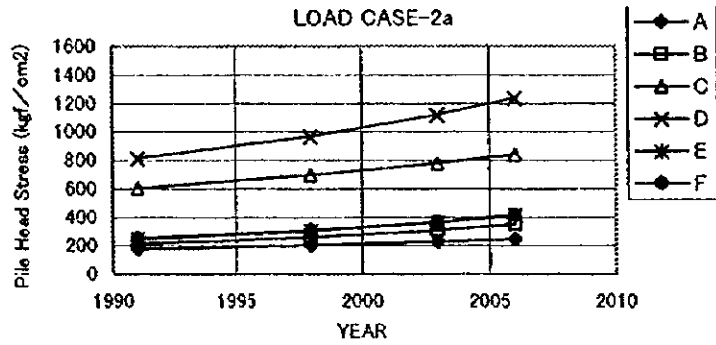
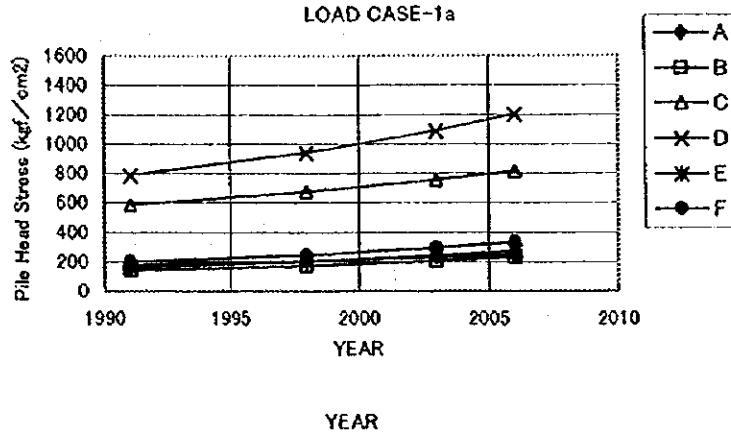
Appendix 8.1 Results of Calculation of Stress on Pile Head

App. Table 8.1(1) Maximum Stresses on Pile Head for Each Load Case

	LOAD CASE	PILE	1991	1998	2003	2006
41.8	1a	D	789	939	1087	1201
	2a	D	811	965	1118	1235
	3a	F	631	777	931	1057
	4a	F	846	1040	1245	1413
58.3	1b	D	827	984	1140	1260
	2b	D	874	1040	1204	1331
	3b	F	801	986	1182	1342
	4b	F	1109	1362	1631	1850
	5	D	981	1169	1354	1497
	6	D	1098	1305	1511	1670
	7	D	879	1046	1212	1340
	8	D	1006	1198	1389	1536

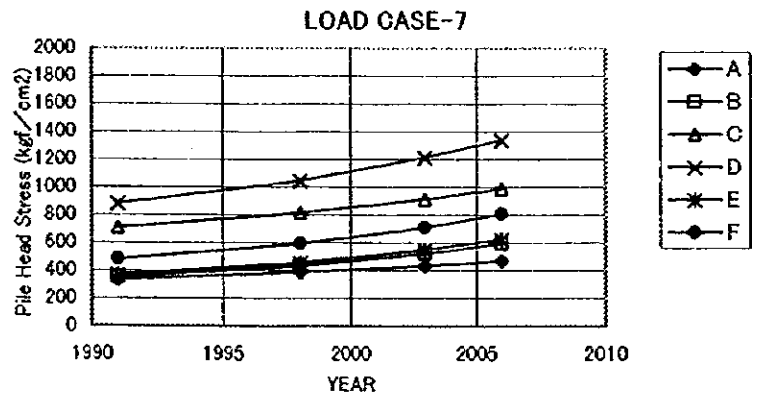
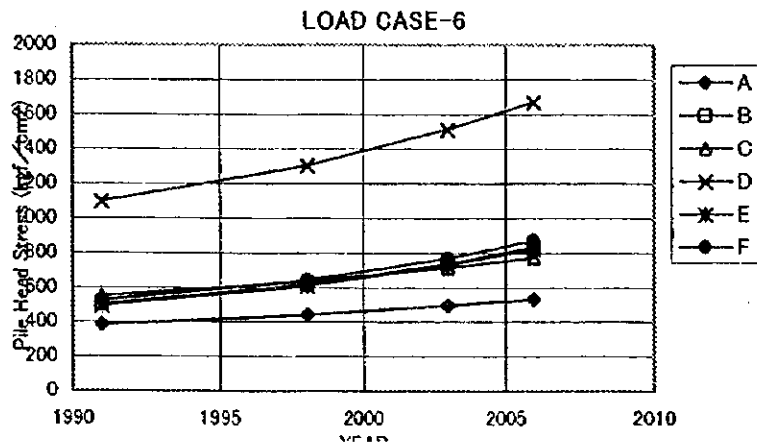
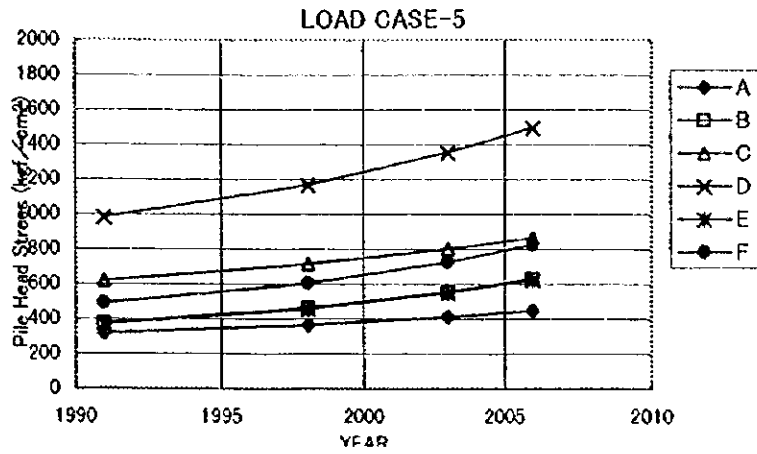
Above data are the results of analysis for ROW-9.

- 1) Permissible stress is assumed to be 1400 kgf/cm².
- 2) The rate of corrosion of pile head is assumed to be 0.3 mm/year.
- 3) The 1a,2a,... 1b,2b,...etc. are the name of load case.

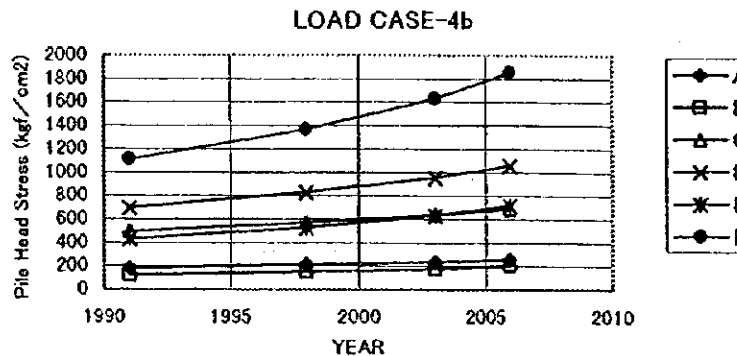
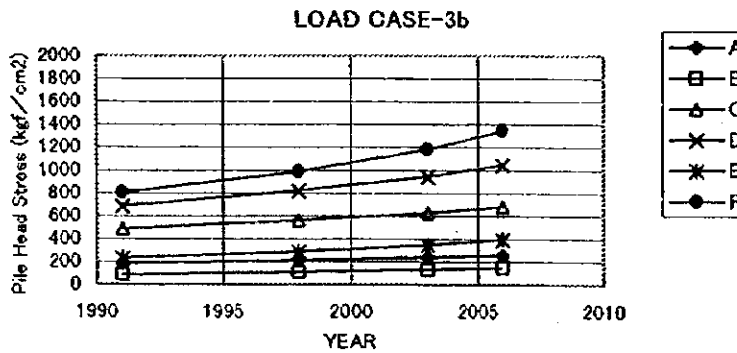
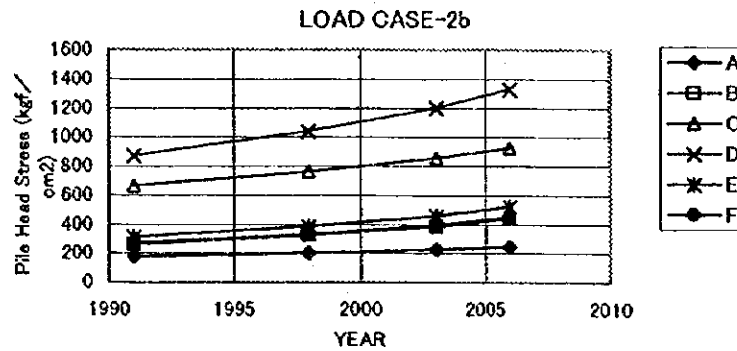
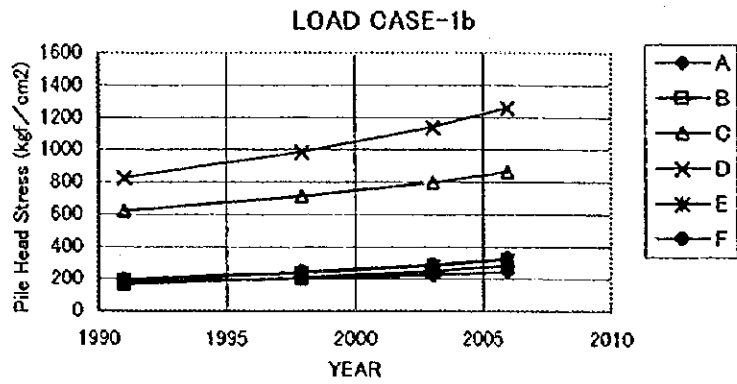


When F = 41.8 (tf) (ROW-9)
Corroding rate of pile head: v=0.30mm/y

App. Figure 8.1(1a) Stree of Pile Head



(Row-9)
 Corroding rate of pile head: $v=0.30\text{mm/y}$
 App. Figure 8.1(1b) Stress of Pile Head



When $F = 58.3$ (tf) (ROW-9)
Corroding rate of pile head: $v = 0.30 \text{ mm/y}$

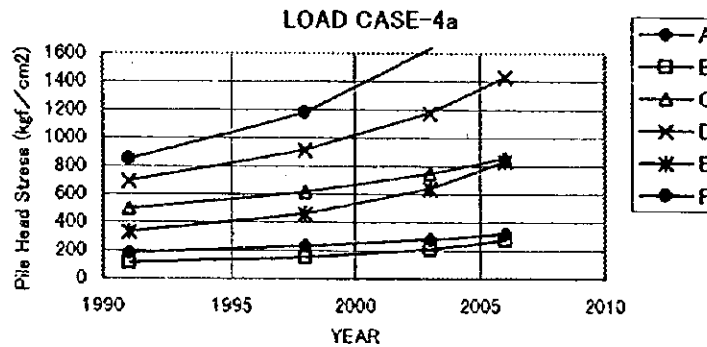
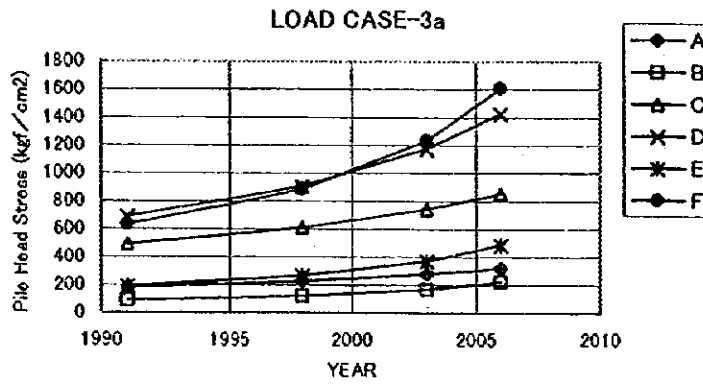
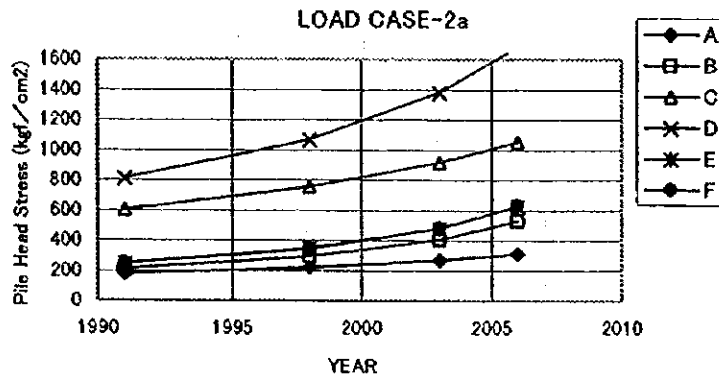
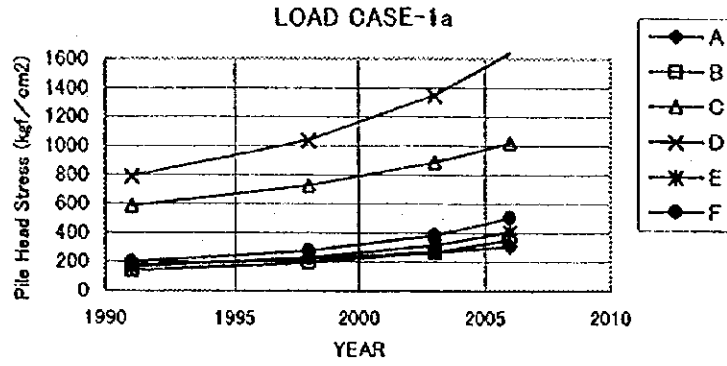
App. Figure 8.1(1c) Stress of Pile Head

App. Table 8.1(2) Maximum Stresses on Pile Head for Each Load Case

	LOAD CASE	PILE	1991	1998	2003	2006
41.8	1a	D	790	1039	1346	1637
	2a	D	812	1068	1383	1683
	3a	F	632	881	1229	1608
	4a	F	846	1175	1633	2135
58.3	1b	D	828	1089	1411	1716
	2b	D	874	1150	1490	1812
	3b	F	803	1118	1559	2040
	4b	F	1107	1538	2137	2794
	5	D	983	1294	1678	2042
	6	D	1101	1447	1872	2276
	7	D	880	1159	1503	1829
	8	D	1008	1327	1721	2094

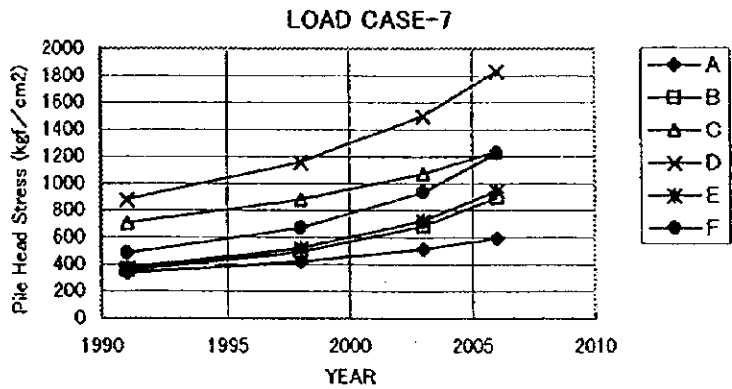
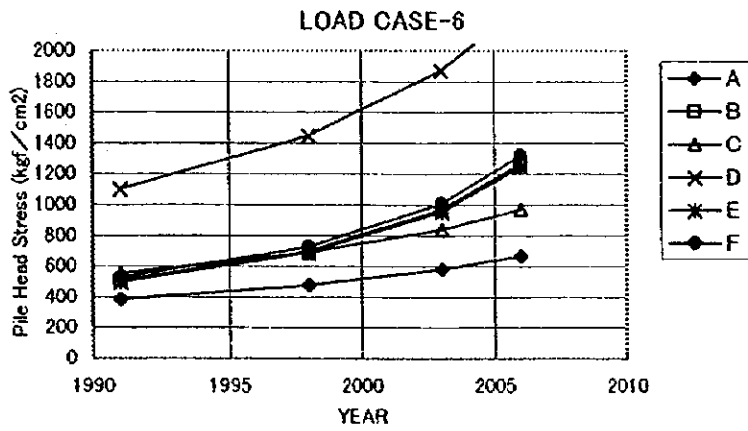
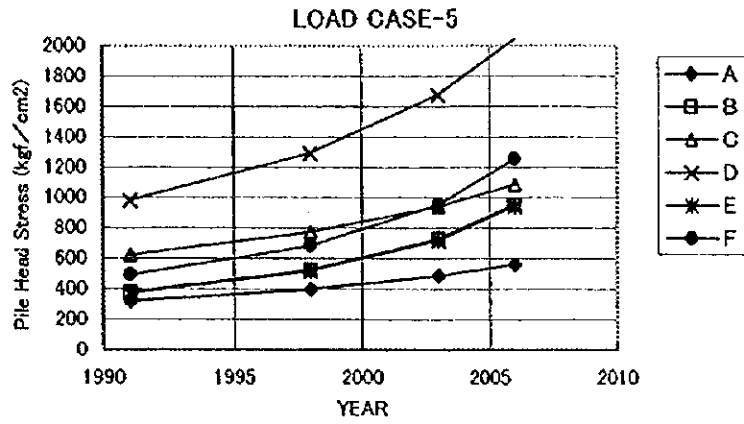
Above data are the results of analysis for ROW-9.

- 1) Permissible stress is assumed to be 1400 kgf/cm².
- 2) The rate of corrosion of pile head is assumed to be 0.45 mm/year.
- 3) The 1a,2a,... 1b,2b,...etc. are the name of load case.



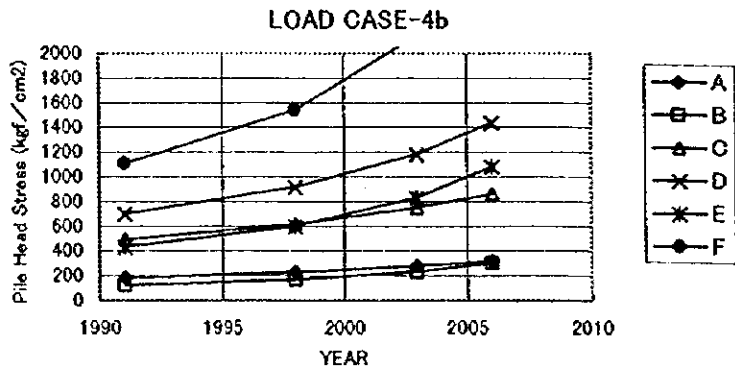
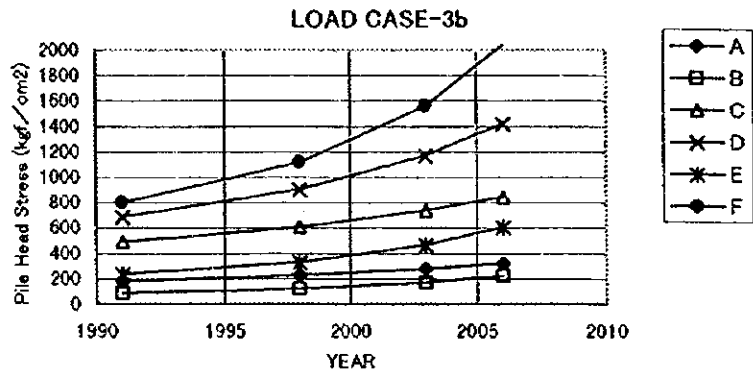
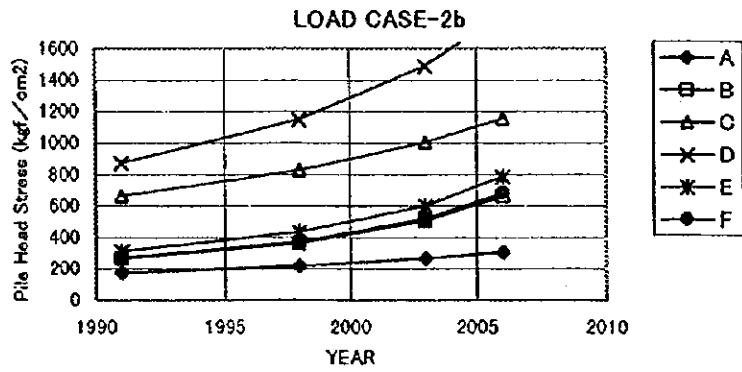
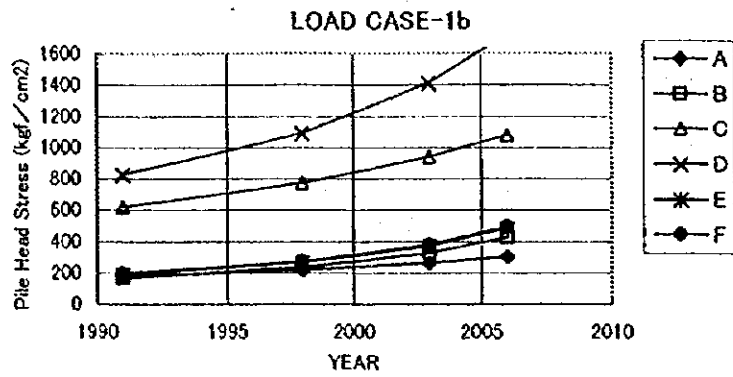
When $F = 41.8$ (tf) (ROW-9)
 Corroding rate of pile head: $v = 0.45 \text{ mm/y}$

App. Figure 8.1(2a) Stress of Pile Head



(Row-9)
Corroding rate of pile head: $v=0.45\text{mm/y}$

App. Figure 8.1(2b) Stress of Pile Head



When $F = 58.3$ (tf) (ROW-9)
Corroding rate of pile head: $v = 0.45 \text{ mm/y}$

App. Figure 8.1(2c) Stress of Pile Head

Appendix 8.2 Axial Force on Pile Head and Permissible Buckling Load

(1) Calculation of the Allowable buckling load

1) Assumption for the calculation

① Pile length

In the case of calculation the buckling load, the pile length is 18 meters. That is the length above the virtual surface (-16m) to the under edge of the superstructure (+2.0m).

It is assumed that about 3 meters from the seabed of the concrete reinforced section is missing. Therefore, the length of the H-shaped steel section is equal to 8 meters and the length of the concrete reinforced section is equal to 10 meters.

② Flexural rigidity of the concrete reinforced section

The concrete reinforced section is regarded as the composite section of concrete and steel. Therefore, its flexural rigidity is determined by applying the following expression.

$$E_2 I_2 = E_s I_s + E_c I_c = E_s \left(I_s + \frac{E_c}{E_s} I_c \right) \quad (1)$$

Where,

- E_2 : modulus of elasticity of composite section
- E_s : modulus of elasticity of steel
- E_c : modulus of elasticity of concrete section
- I_2 : geometrical moment of inertia of composite section
- I_s : geometrical moment of inertia of H-shaped steel
- I_c : geometrical moment of inertia of concrete section

③ Supporting condition

Fixed ends

2) Method of calculation

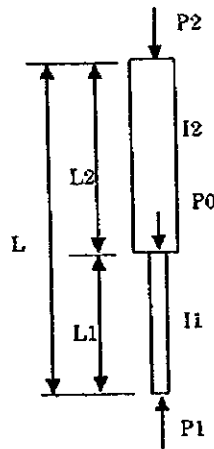
The basic expression on the buckling load is as follows.

$$(P_2)_{cr} = \mu^2 \frac{E_2 I_2}{l_2^2} \quad (2)$$

Where,

- μ : the coefficient of buckling
- E_2 : modulus of elasticity of composite section
- I_2 : geometrical moment of inertia of composite section
- l_2 : the length of pile of composite section

The modeled cross section of the pile is shown in bellow.



Modeled Cross Section of Pile

The buckling coefficient m is given by the first root of the next equation and the diagram is shown in Appendix Figure (see next page).

$$\begin{aligned} & \mu \left(\frac{P_0}{P_1} - \frac{l}{l_2} \right) \left(\tan \mu + \frac{l_1}{l_2} \frac{I_2}{I_1} \tan k\mu \right) + \left(\frac{l_2}{l_1} k + \frac{1}{k} \frac{l_1}{l_2} \right) \tan k\mu \tan \mu \\ & = \frac{P_0^2 + P_1^2 + P_2^2}{2P_1 P_2} - \frac{2}{\cos k\mu \cos \mu} - 2 \frac{I_1}{I_2} \frac{1}{\cos k\mu} + 2 \frac{P_1}{P_2} \frac{1}{\cos \mu} \end{aligned}$$

Where

$$k = \frac{l_1}{l_2} \sqrt{\frac{P_1 I_2}{P_2 I_1}} \quad m = \frac{l^2 \mu^2}{l_2^2 \pi^2} \quad \alpha = \frac{P_1}{P_2}$$

3) Allowable buckling load

Allowable buckling load at the time of 1966, 1991, 1998, 2003 and 2006 year are calculated and shown in App. Table 8.2(2) and 8.2(3).

App. Table 8.2(1) Axial Force on Pile Head for Various Loadings on Existing Wharf

PILE	Axle Load = 41.8 tf				Axle Load = 58.3 tf				5	6	7	8
	1a	2a	3a	4a	1b	2b	3b	4b				
A	22	22	22	22	22	22	22	22	53	20	53	53
B	11	11	7	7	12	12	7	7	35	6	34	35
C	29	27	11	11	35	33	11	11	38	65	51	35
D	37	35	21	21	43	41	20	21	64	31	51	67
E	11	10	12	12	12	12	14	13	36	8	36	36
F	16	16	48	45	16	16	60	56	47	19	47	47

*) The 1a,2a,... 1b,2b,...etc. are the name of load case.

App. Table 8.2(2) Permissible Buckling Load for Existing Wharf

PILE	Permissible Buckling Load (tf)				
	1966 Year	1991 Year	1998 Year	2003 Year	2006 Year
A	139.6	134.3	133.9	133.7	133.5
B	67.9	64.9	64.7	64.5	64.5
C	110.9	106.7	106.4	106.0	106.0
D	110.9	106.7	106.4	106.0	106.0
E	67.9	64.7	64.7	64.5	64.5
F	67.9	64.7	64.7	64.5	64.5

The corrosion rate: 0.02 mm/year (Non-Protection)
 0.005 mm/year (Protection)

App. Table 8.2(3) Permissible Buckling Load for Existing Wharf

PILE	Permissible Buckling Load (tf)				
	1966 Year	1991 Year	1998 Year	2003 Year	2006 Year
A	139.6	129.0	128.0	127.7	127.4
B	67.9	61.9	61.5	61.2	61.0
C	110.9	102.4	101.8	101.4	101.2
D	110.9	102.4	101.8	101.4	101.2
E	67.9	61.9	61.5	61.2	61.0
F	67.9	61.9	61.5	61.2	61.0

The corrosion rate: 0.04 mm/year (Non-Protection)
 0.01 mm/year (Protection)

Appendix 9 Cargo Forecast
(9.1) Micro Forecast of Import Commodities

(9.1.1) Oil products

(a) For motor Vehicles (motor spirits, distillate fuels)

Table 9.1.1-1 Number of Motor Vehicles Registered

Year	(A) Vehicles Total	(B) Population (1000 persons)	(A/B) %
1980	3,965	156,193	25.4
1981	4,338	156,349	27.7
1982	3,818	156,505	24.4
1983	3,911	156,662	25.0
1984	4,326	156,819	27.6
1985	4,372	156,975	27.9
1986	3,633	157,158	23.1
1987	3,724	157,977	23.6
1988	3,793	158,800	23.9
1989	4,914	159,627	30.8
1990	5,181	160,459	32.3
1991	6,036	161,298	37.4
1992	7,151	162,675	44.0
1993	5,038	163,089	30.9
1994	7,370	163,592	45.1

Note : Vehicles total exclude motor cycles.

The unit number of vehicles(A/B) was assumed to be increased at an annual rate of 2.1% from 1985 to 2005 in 1987 Master Plan. So, it is assumed to be increased at an annual rate of 2.1% from 1995 to 2015 based in 1991.

Table 9.1.1-2 Forecast of This Project

Year	(A) Motor Vehicles	(B) Population (1000 persons)	(A/B) Unit Number of Vehicles	Oil Products (tons)
1985	4,372	157	27.9	18,044
1995	6,669	164.1	40.6	27,523
1996	6,829	164.6	41.5	28,184
1997	6,992	165.0	42.4	28,859
2003	8,050	167.7	48.0	33,222
2005	8,433	168.6	50.0	34,805
2015	10,619	172.4	61.6	43,827

note : Oil products are 4.1 tons per vehicle in 2005 as same as in 1985.

(b) For airplanes (kerosine, white spirits)

It is assumed that the annual increase rate of person-kilometers transported by airplanes will be 4.3% from 1986 to 2005.

Table 9.1.1-3 Volume of airplane fuel

Year	the volume of airplane fuel(tons)
1985	6,100
2003	13,015
2005	14,200
2015	21,570

(c) For Diesel Energy Generation

Table 9.1.1-4 Volume of Diesel fuel

(tons)	1985	2000	2005
Consumption volume	2,900	1,100	800
annual decrease rate		-6.20%	-6.20%

Table 9.1.1-5 Total of Import Oil

(a)+(b)+(c)	1990	1991	1992	1993	1994	1995	1996	1997	2003	2005	2015
Imports of Oil Products	21,383	24,912	29,513	20,793	30,417	27,523	28,184	28,859	33,222	34,805	43,827
(a) motor vehicles	7,529	7,853	8,191	8,543	8,910	9,293	9,693	10,110	13,015	14,200	21,570
(b) airplanes	2,106	1,975	1,853	1,738	1,630	1,529	1,434	1,345	916	800	425
(c) diesel	31,018	34,740	39,557	31,073	40,958	38,346	39,311	40,314	47,154	49,805	65,823
Total of Oil Products	3,171	3,630	4,234	3,042	4,326	3,922	3,998	4,078	4,609	4,807	5,974
Imports of Asau Port	27,847	31,110	35,322	28,032	36,631	34,423	35,313	36,236	42,545	44,999	59,849
Imports of Apia Port	9,635	20,639	43,864	41,255	35,197	27,050	31,899	39,530			
Actual Imports of Oil	2,890	1,507	0,805	0,679	1,041	1,273	1,107	0,917			
Rate(%) of Forecast											

(9.1.2) Sugar

Table 9.1.2-1 Sugar Consumption per Capita in 1983

year	Sugar consumption		Consumption per capita (kg)
	country	Population (thousand)	
1983	Samoa	157	56.5
	World	4,690,000	20.7
2005	Samoa	169	56.5

Sugar Consumption per Capita after 1996

year	Sugar consumption		Population (thousand)	Consumption per capita (kg)
	country	(tons)		
1983	Samoa	8,870	157	56.5
2003	Samoa	9,490	168	56.5
2005	Samoa	9,500	169	56.5
2015	Samoa	9,700	172	56.5

(9.1.3) Cement, Steel Products

Table 9.1.3-1 GDP and Investment

Real GDP	GDP		Investment		Share in GDP (%)		Forecast	
	1988	1989	1989	1990	1990	1991	1996	2005
	140.8	144.5	133.7	130.7	141.2	146.7	157	184.3
Private Investment	6.9	8.6	5.6	7.8	8.0	7.8	7.1	6.9
Government Investment	38.9	39	61.1	62.3	53.8	52.7	47.4	46.2
Investment at 1982 price	45.8	47.6	70.1	70.1	61.8	60.5	54.5	53.1
Share in GDP (%)	32.5%	32.9%	43.7%	53.6%	43.8%	46.0%	37.1%	28.8%
								28.8%

Source : (1) Treasury Department, Fund staff estimates (2) Statistics Department, (Statistics on the Economy of Samoa)

(9.1.4) Cereals

Average annual increased rate of Cereals of 1987 Master Plan was 4.72% in 1978-1983. Imports of Cereals is in proportion to population, so that average annual increased rate is 2.36%.

Table 9.1.4-1 Average annual growth rate of population

Av. Annual growth rate of Population in 1978 - 1983	0.6%
Period of This Project	0.3%

(9.1.5) Materials of Wiring Harnesses

Table 9.1.5-1 Import of Materials of Wiring Harnesses

Wiring Harness (ton)	1991	1992	1993	1994	1995	1996	1997
Imports of Materials	76	1,310	1,311	1,311	1,980	2,970	3,443

Forecast			
	2003	2005	2015
	3,500	3,500	3,500

(9.1.6) Other Imports

Table 9.1.6-1 Other Import

	1990	1991	1992	1993	1994	1995	1996	1997	2003	2005	2015
Sugar	9,066	9,113	9,185	9,215	9,243	9,271	9,298	9,325	9,476	9,524	9,742
General Cement	14,451	17,346	17,371	16,286	14,981	13,483	11,191	11,191	12,828	13,136	15,702
Cargo Steel	8,939	10,730	10,745	9,456	9,266	8,340	6,922	6,922	7,935	8,126	9,713
Cereal	10,369	10,614	10,864	11,121	11,383	11,662	11,927	12,208	14,042	14,713	18,578
W/H Mater	0	76	1,310	1,311	1,311	1,980	2,970	3,443	3,500	3,500	3,500
Other	77,684	33,621	39,021	66,703	133,863	88,868	129,010	144,401			
Total of Actual Impo	120,509	81,500	88,497	113,091	180,047	133,593	171,317	187,490			

	1991	1992	1993	1994	1995
1st three years moving average	45,987	44,592	76,573	105,824	110,152

As the maximum volume of other, 105,824 tons in 1994 is adopted and 76,573 tons in 1993 is adopted as the minimum volume of other. The Other imports is assumed to be increased at an annual rate of 6.5% of total actual imports from 1990 to 1997.

	1993	1994	2003	2005	2015
Others-max in 1994(+6.5% per annum)		105,824	186,523	211,559	397,124
Others-min in 1993(+6.5% per annum)	76,573		143,737	163,030	306,030

(9.1.7) Effect of New Import Duty Rate

Table 9.1.7-1 Elasticity Rate of Volume for Price

Year	(A) Japan		(B) Germany		(C) Japan		(D) Germany		(C+D)/2
	1996	1997	1996	1997	1996	1997	1996	1997	
Annual average exchange rate to US\$ in 1990-1995	100.0	100.0	100.0	100.0	1.090	1.024	1.057		
Annual average growth rate in 1990-1995	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.057
1990	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.057
1991	90.6	101.7	96.2	104.0	104.0	112.7	108.4	108.4	8.3%
1992	84.2	98.6	91.4	103.6	103.6	115.3	109.5	109.5	1.0%
1993	74.5	93.2	83.9	106.6	106.6	114.4	110.6	110.6	1.0%
1994	68.6	95.0	81.8	121.1	121.1	113.5	117.3	117.3	6.2%
1995	68.3	97.6	83.0	136.4	136.4	115.4	126.9	126.9	7.3%
Annual average growth rate in 1990-1995									4.8%
Source: IMF, International Financial Statistics									-1.1%

Table 9.1.7-2 Import Value, Import Duties and Import Volume in 1995-1997

Year	1995	1996	1997	average	Rate
(A) Import Value (1,000W\$)	228,041	249,724	256,224	242,663	100.0%
(C) Import Duties	50,648	63,248	57,980	57,091	23.5%
(B) Import Volume (tons)	160,643	208,216	227,020	196,960	
(A/B) Import Unit Price per ton	1.42	1.20	1.13	1.23	

Table 9.1.7-3 Forecast Weighting Average Share of New Import Duties of General Cargo in 1995-1997

Existing Duty Rate	5%	10%	20%	35%-42%	50%-60%	23.5%
New Duty Rate	0%	5%	10%	16%	20%	11.6%
weight	11.3%	16.7%	16.7%	22.1%	16.7%	100.0%

Table 9.1.7-4 Volume Effect of New Import Duty for Oil Products and General Cargo

Imports	Import Value (CIF) (1,000W\$)		(A) Existing Import Duties		New Rate Duties		Price Down		(D) Rate (B-C)/(A)
	1996	1997	Old Rate	(B)	New Rate	(C)	(D)/(C)	(B-C)/(A)	
for motor spirits	7,575	9,062	15,126	10,588	50%	5,294	0	5,294	
for airplane	7,907	8,248	8,603	8,253	10%	860	0	860	
for diesel	375	352	330	352	35%	125	0	125	
for residual fuel oil	7,326	11,071	2,031	6,810	42%	2,860	2,860	0	
Total of Oil Products	23,184	28,733	26,090	26,002	35%	9,137	2,860	6,277	24.1%
Import General Cargo	204,857	214,991	230,134	216,661	22.1%	47,954	5,584	42,370	19.6%
Total of Imports	228,041	243,724	256,224	242,663	23.5%	57,091	8,444	48,647	20.0%
(E) Volume in 1997 (tons)					(F) Share of consumer				
Oil Products	39,530	50%	0.982	1,057	(G) exchange rate of US\$ for Yen/DM in 1990-1995	0.113	4,479	0.097	0.011
General Cargo	187,490	50%	0.982	1,057	(H) Elasticity Rate of Volume for 1990-1995	0.092	17,209	0.046	0.009
Total of Imports	227,020				(I) Volume Increasing Rate (=D*/F *G/H*I)	0.092	17,209	0.046	0.009

note-1: Volume effect is assumed 100% in 1998-2003, 50% in 2004-2009 and 10% in 2010-2015.

(9.2) Micro Forecast of Export Commodities

Table 9.2.1-1 Trend of Quantity of Major Exports

Commodities	1982	1983	1984	1985	1986	1987	1988	1989
Coconut oil(ton)	8,027	12,188	10,651	12,103	12,555	11,527	10,330	6,292
Cocoa(long ton)	770	2,123	709	559	1,240	839	467	595
Copra meal(ton)						5,170	5,281	3,058
Copra(long ton)						561	3,230	5,850
Taro(ton)	4,893	4,264	6,186	7,200	5,942	7,829	6,675	9,227
Coconut cream(ton)						1,002	1,166	1,499
Other Exports (ton)	34,486	28,873	39,807	36,197	32,134	15,147	19,948	1,942
Total of Exports	48,175	47,448	55,953	56,059	51,871	42,075	47,097	28,463

Commodity	1990	1991	1992	1993	1994	1995	1996	1997
Taro	4,474	7,409	3,740	7,060	70	70	35	35
Agricultural Products								
Cocoa	222	2				2,624	4,064	3,205
Copra meal	2,215		36		64	2,502	4,659	8,555
Copra	2,400				1,211	1,380	1,413	1,343
Coconut cream	1,576	1,557	1,295	960	33	34	90	478
Fish	47	21	15					2,576
Wiring harnesses		104	1,787	1,788	1,788	2,700	4,050	4,696
Others	6,112	12,551	4,128	7,058	17,324	19,256	7,957	5,526
General Cargo of Apia Port	17,045	21,645	11,001	16,898	20,491	22,621	22,056	25,936
Oil (Coconut Oil)	5,188	35	837			6,782	6,489	5,675
Export Total of Apia Port	22,233	21,680	11,838	16,898	20,491	29,403	28,545	31,611
Timber of Asau Port	68	33	33	126	645	865	3,407	512
Export Total	22,301	21,713	11,871	17,024	21,136	30,268	31,952	32,123

Table 9.2.1-2 Trend of Export of Timber from Asau Port

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Value (000 US\$)	540.6	1,478.2	754.6	780.2	396.0	1,084.0	136.0	21.0	10.0	22.0	31.0	163.0	208.0	832.0	124.0
Quantity(000 ft ³)	1,048.9	1,280.1	1,199.0	722.7	102.1	211.4	93.7	16.5	7.9	8.0	30.4	155.4	208.4	820.7	123.3
metric tons	4,354	5,314	4,977	3,000	424	878	389	68	33	33	126	645	865	3,407	512

Table 9.2.1-3 Assumption of Forecast of Export of Revised Plan

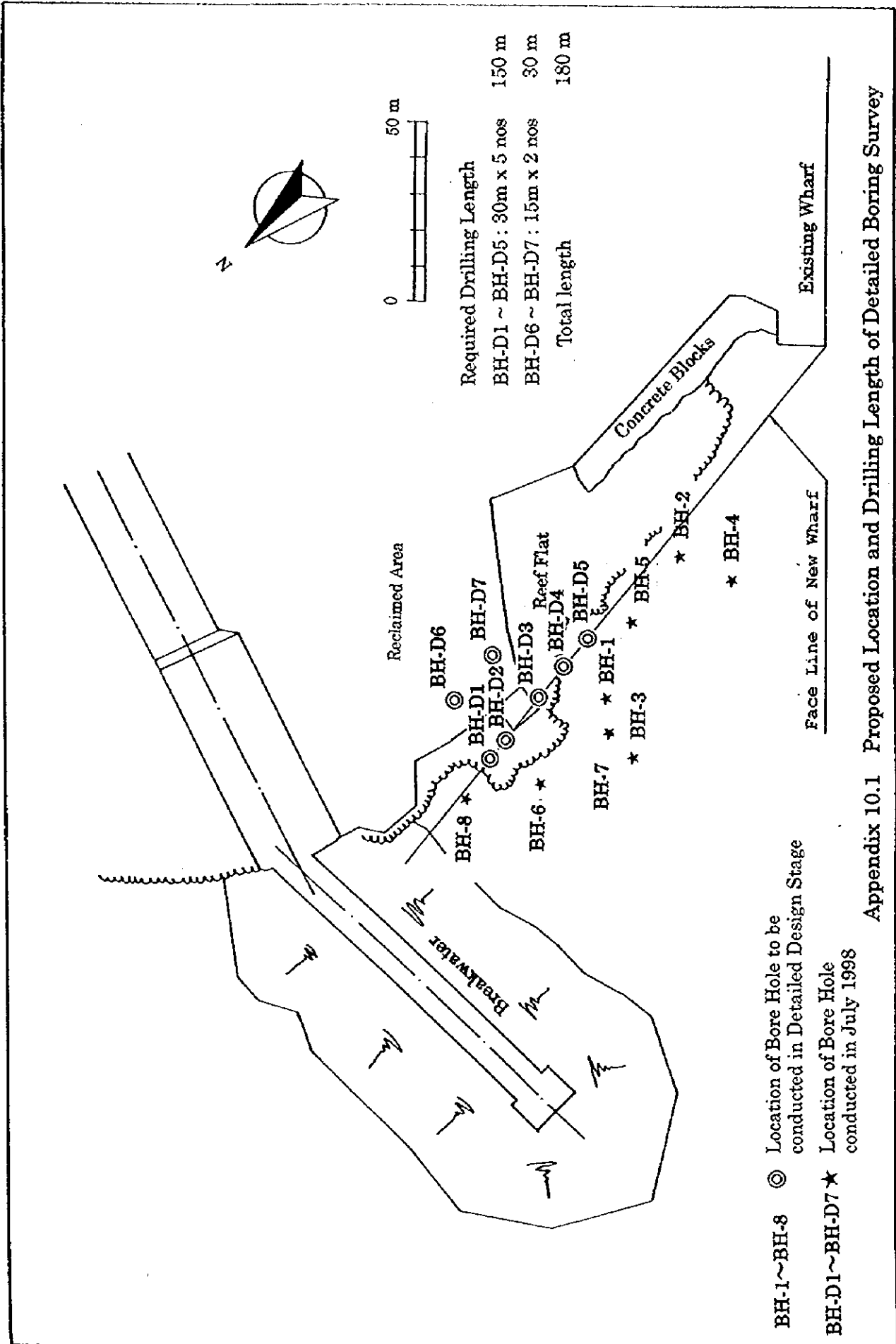
Commodity	the level before 1990	Average annual growth rate	Assumption of Forecast after 5, 10, 15 years	2003	2005	2015
Taro	7,602	(+0.53%)	data from Agriculture Dep.	2,737	4,667	7,723
Cocoa	592	(+10.6%)	data from Agriculture Dep.	214	284	801
Copra meal	4,698	(+2.84%)	data from Agriculture Dep.	4,245	4,489	5,940
Copra	3,218	(+2.04%)	in 1988-1996 of 3 years av.	5,862	6,109	8,672
Coconut cream	1,208	(+1.74%)	in 1988-1996 of 3 years av.	1,687	1,620	2,362
Fish		(+10.0%)	estimated by Fishery Division	4,564	5,523	10,000
Wiring harnesses		constant	data from W/H company	4,700	4,700	4,700
Others		(+2.8%)	data from Agriculture Dep.	11,015	11,640	15,343
General Cargo of Apia Port				36,029	39,033	55,541
Oil (Coconut Oil)	9,620	(+2.8%)	data from Agriculture Dep.	9,883	10,451	13,775
Export Total of Apia Port			Recovery of 100% (9,620) after 5 years	44,919	49,484	69,315
Timber of Asau Port		(+1.3%)	in 1985-1996	3,798	3,898	4,435
Export Total			annual growth +1.3% based 3,407 1996	48,717	53,381	73,751

Appendix 9.4 Table 9.4.1-1 Revised Method of This Project

(1) Macro-Forecast		Revised Method of This Project		1993	2003	2015
Population, (census 160,349 persons in 1981) (census 167,188 persons in 1986) (census 161,298 persons in 1991)	[Population] Same as in 1987 (The difference between the census population and the forecast by This equation is only 0.468 %). $Y = 7.611 \cdot X^{0.433}$ ($r = 0.989$)	[Gross Investment Share in real GDP] 28.8 % = Actual share in 1986 owing to Fiscal Policy of Economic Strategy 1988 - 1989 to keep the budget balance	164.6	167.7	168.0	172.4
Real GDP at 1982 prices (Ave. annual growth rate)	[Real GDP and average growth rate] (1) Revised at 1982 prices from 1980 prices (2) Real GDP 167 m. Tala in 1986 included for Wiring Harnesses (bright's disease's disaster, Exporting Structure has been changed, so that we need the Revised Equation of This Project as shown as follows; (3) 4.5% = Maximum of average annual growth rate (Macroeconomic Policy Framework of Economic Strategy 1988-1989 on Governmental Target) [340 m. Tala in 2016] (4) 1.7% = Minimum of average annual growth rate (Actual average annual growth rate during 1980 - 1989 before the Cyclone coming in 1990) [202.6 m. Tala in 2016] (5) Real GDP of This Project is assumed to 220 million Tala in 2016, so that average annual growth rate of real GDP is to 1.7-2.0%	[Equation of General Cargo Volume by Real GDP] Since the biggest two cyclones's coming and Taro leaf bright's disease's disaster, Exporting Structure has been changed, so that we need the Revised Equation of This Project as shown as follows; $Y = 3.591 \cdot X - 367.609$ ($r = 0.94601$) Y : General Cargo Volume of Apia Port (tone) X : Real GDP at 1982 prices (Tala million) in 1990-1997 except 1994 (Leaf bright's disease decrease for Taro to be half of its production).	167.0	180	186	220
Real GDP-max (Ave. annual growth rate)			7.5%	2.0%	1.7%	1.7%
Real GDP-min (Ave. annual growth rate)					213.6	339.5
Gross Investment at 1982 prices Share in GDP					169.7	198.9
General Cargo Volume of Samoa (Total)					1.7%	1.7%
(Import)					45.2	61.8
(Export)					53.6	63.4
					28.80%	28.80%
					193.373	
					171.317	
					22.066	

(2) Micro-Forecast		1986	1987	2003	2005	2015
Commodity	Method of Forecast (for example in 2015)	6,820	6,992	8,050	8,433	10,619
(A) Motor Vehicles	37,911 = 18,044 tons / 4,372 * 10,619 * (1-0.135) (Asau Port)	166	165	168	169	172
(B) Population	Oil products 18,044 tons in 1986 Unit number of vehicles = increased at +2.1% per annum	41	42	48	50	52
(A)/(B)	4,372 = number of vehicles in 1986, = forecast for the number of vehicles in 2015 = 172,400 p * 61.6/1000p.	24,379	24,963	28,757	30,107	37,911
Oil Products	10,619 = forecast for the number of vehicles in 2015 = 172,400 p * 61.6/1000p.	9,693	10,110	13,016	14,168	21,970
Oil for airplanes (+4.3% per annum)	21,670 = 6100 * 3.043 * (2015-1986)	1,241	1,164	753	687	348
Diesel oil (+6.2% per annum)	369 = (+6.2% per annum) from 2,600 tons in 1985 * (1-0.136)	30,313	36,236	47,353	49,327	60,807
Volume effect of New Import Duties	(average annual rate: +1.3% in 1988-2003, +9.7% in 2004-2009, +1.1% in 2010-2015)	9,208	9,325	9,476	9,624	9,742
Oil Product total	698 = (379.11 + 21670 + 369) * 1.011	45	45	62	63	63
Sugar (66.5 kg per Capita)	9742 = 169,000p. in 2015 * 66.5 kg per Capita	11,191	11,191	12,828	13,136	15,702
Gross Investment, 1982 prices	63.4 Tala million = 29.8 % (in 1986) of Real GDP (220 Tala million)	6,922	6,922	7,935	8,126	9,713
Cement	15,702 = 9,700 * 63.6/99.2	2,970	3,443	3,500	3,600	3,600
Steel Products	9,713 = 9,000 * 63.6/99.2	120,028	127,830	146,623	211,569	397,124
W/H Material	18,578 = Av. annual increase rate +2.36% in 3-year moving average 1978-1983 constant 3,600 tons after 1986	92,496	98,508	143,737	163,030	306,030
Others-max. (+5.36% based in 1984)	316,793 = annual rate +5.36% in 1981-1986 from 106,824 tons in 1984					
Others-min. (+6.36% based in 1993)	221,248 = +6.36% in 1981-1986 from 70,146 tons of 3-years moving average in 1993					
Effect of New Import Duties for Max. General Cargo	(average annual rate: +0.2% in 1989-2003, +4.6% in 2004-2009, +0.9% in 2010-2015)			21,606	11,968	4,170
Effect of New Import Duties for Min. General Cargo	(average annual rate: +9.2% in 1988-2003, +4.6% in 2004-2009, +0.9% in 2010-2015)			17,579	9,731	3,334
Import-max Total (Others-max)		197,649	207,155	303,162	321,842	519,037
Import-min Total (Others-min)		170,116	177,833	256,449	271,087	427,107

Commodity		before 1990	1997	2003	2006	2015
Taro	7,302	36	30	2,797	4,667	7,723
Agricultural Products	692	0	0	214	284	801
Cocoa	4,698	4,064	3,205	4,246	4,489	6,940
Copra meal	3,218	4,659	8,555	5,857	6,109	8,672
Copra	1,208	1,413	1,343	1,687	1,620	2,362
Coconut cream	0	478	2,576	4,054	5,523	10,000
Fish	0	4,050	4,096	4,700	4,700	4,700
Wiring harnesses	0	7,357	6,895	11,016	11,640	16,343
Others	0	22,059	27,296	36,029	39,033	65,041
General Cargo of Apia Port	9,620	6,499	4,315	9,889	10,461	13,715
Oil (Coconut Oil)		28,046	31,611	44,919	49,464	69,310
Export Total of Apia Port		3,407	612	3,798	4,436	4,436
Timber of Asau Port		31,952	32,123	48,717	63,381	73,751
Export Total						



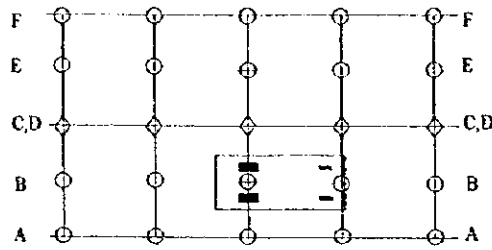
BH-1~BH-8 © Location of Bore Hole to be conducted in Detailed Design Stage

BH-D1~BH-D7 ★ Location of Bore Hole conducted in July 1998

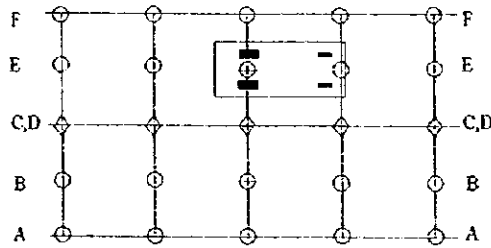
Appendix 10.1 Proposed Location and Drilling Length of Detailed Boring Survey

Appendix 10.2 Results of Structural Analysis of Wheel Load T-20

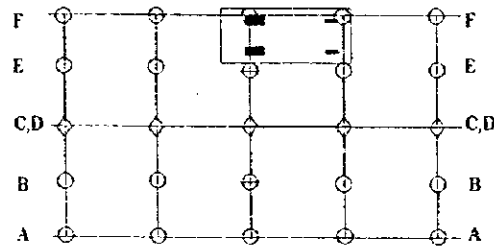
(1) Load Case-1



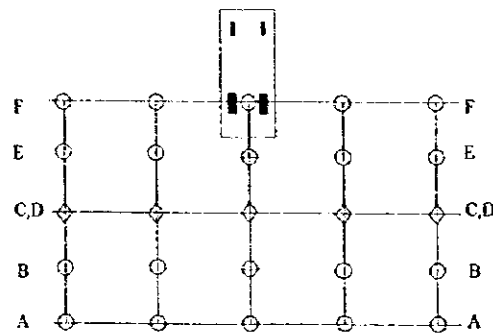
(2) Load Case-2



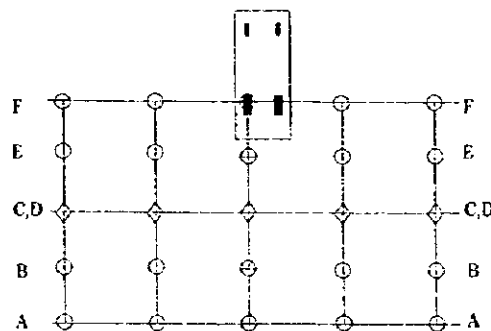
(3) Load Case-3



(4) Load Case-4

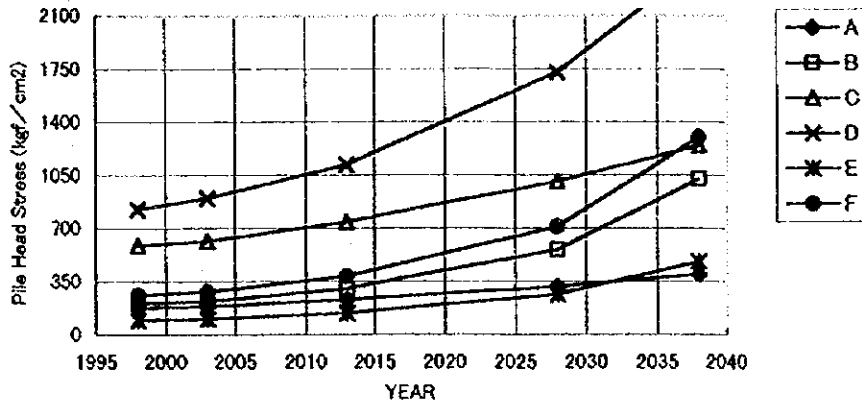


(5) Load Case-5

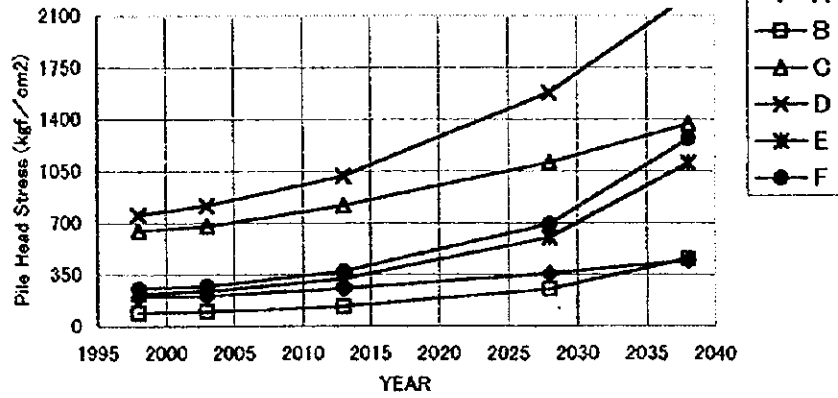


App. Figure 10.2-1 Position of T-20 at Existing Wharf
A10-2

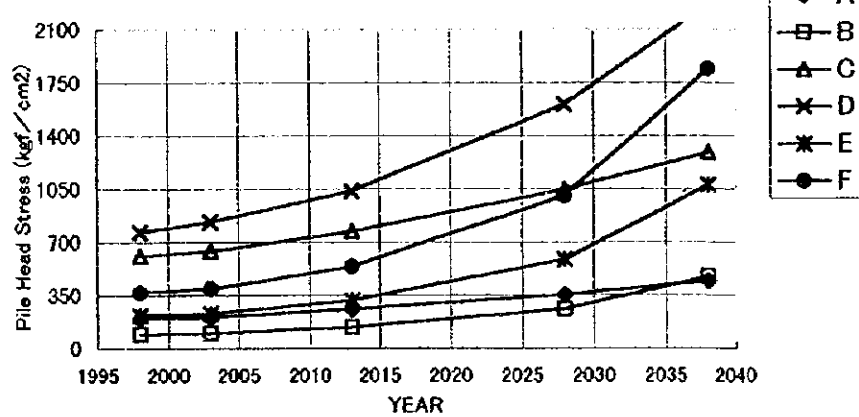
LOAD CASE-1



LOAD CASE-2



LOAD CASE-3



(ROW-9)

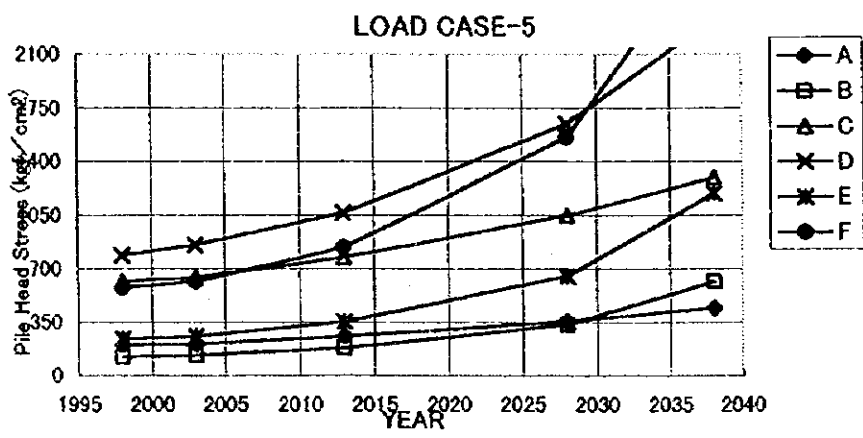
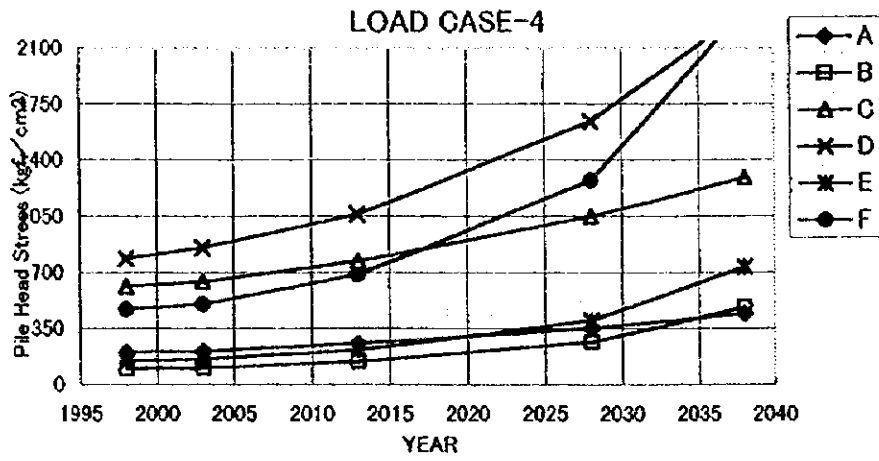
Corroding rate of pile head:

Between 1991-2002 years $v=0.30\text{mm/y}$

After 2003 year $v=0.15\text{mm/y}$

Load= T-20

App. Figure 10.2-2 Stress of Pile Head



(ROW-9)

Corroding rate of pile head:
 Between 1991-2002 years $v=0.30\text{mm/y}$
 After 2003 year $v=0.15\text{mm/y}$

Load= T-20

App. Figure 10.2-3 Stress of Pile Head

Appendix 10.3 Reinforcement of Pile Head and Additional Piles

(1) Reinforcement of Existing Piles

The following reinforcement method is considered. The pile head is reinforced by steel bar, and structure of existing wharf is reinforced by additional Piles in one row. It is considered as reinforcement standard that the stress of H pile and reinforced bar are not exceed 1400kgf/cm² and 1800 kgf/cm² respectively(the period of 30 years).

The corrosion rates of pile head are assumed as below:

1991-2002 year	Vc=0.3 mm/year (before reinforcing)
2003-2032 year	Vc=0.15 mm/year (after reinforcing)

Th stress of the original model (the existing wharf before reinforcing), the model of adding one pile , the model of adding two piles, and results of safety judgement are shown in App. Table 10.2. The three type of steel bar are considered respectively. The number of allowable reinforced bar in cross section of pile head is calculated.

(2) Results of Calculation

According to the calculation results, two additional piles are required.

App. Table 10.3 Stress of H-pile and Reinforcement Bar of Pile Head at 2032 Year

Model	Pile	$\phi=22\text{mm}$				$\phi=25\text{mm}$				$\phi=29\text{mm}$						
		Before Repairing H steel σ_H (kgf/cm ²)	N	After Repairing H steel σ_H (kgf/cm ²)	Judgement	Before Repairing H steel σ_H (kgf/cm ²)	N	After Repairing H steel σ_H (kgf/cm ²)	Judgement	Before Repairing H steel σ_H (kgf/cm ²)	N	After Repairing H steel σ_H (kgf/cm ²)	Judgement			
Original model	D	2498	50	1500	2338	NO	2498	50	1380	2162	NO	2498	50	1233	1790	NO
	F	4636	50	1305	2038	NO	4636	46	1135	1782	NO	4636	32	1135	1785	NO
Increase 1 pile model	D	2423	50	1243	1938	NO	2423	50	1131	1772	NO	2423	34	1139	1776	NO
	F	3176	38	1136	1773	NO	3176	30	1092	1715	OK	3176	22	1064	1649	OK
Increase 2 pile model	D	2099	36	1141	1778	NO	2099	26	1142	1789	OK	2099	20	1113	1755	OK
	F	3160	36	1145	1787	NO	3160	28	1146	1799	NO	3160	18	1147	1816	OK

Number of allowable bar on Pile D: 30

Number of allowable bar on Pile D: 26

Number of allowable bar on Pile D: 22

F: 24

F: 21

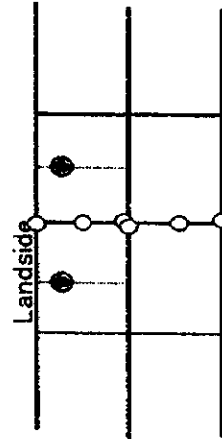
F: 18

The corrosion rate of pile head is assumed as below

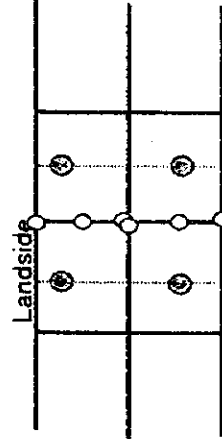
1991-2002 year $V_c=0.3\text{mm}/\text{year}$

2003-2032 year $V_c=0.15\text{mm}/\text{year}$

One additional pile model



Two Additional pile model



Appendix 10.4 Calculation of Calmness in Front of New Wharf and Working Ratio of Cargo Handling

The results of calmness in front of the new wharf and working ratio of handling are shown as follows.

(1) Wave

The dimensions of offshore wave is applied typical wave presented in the feasibility study 1987 as shown in App. Table 10.4-1 and App. Figure 10.4-1.

Table 10.4-1 Dimension of Offshore Wave

	Direction	Period	Ratio of Wave Height
Offshore	N 10° E	10 sec	1.0
Breakwater	N	10 sec	0.64

(2) Transmission Coefficient

The transmission coefficient of the existing breakwater is applied as follows.

Before improvement (at present)	20 %
After improvement	0 %

(3) Calculation of Calmness of Berthing Area

The results of calculation of calmness in front of the new wharf are shown in App. Figure 10.4-2.

(4) Working Ratio of Cargo Handling

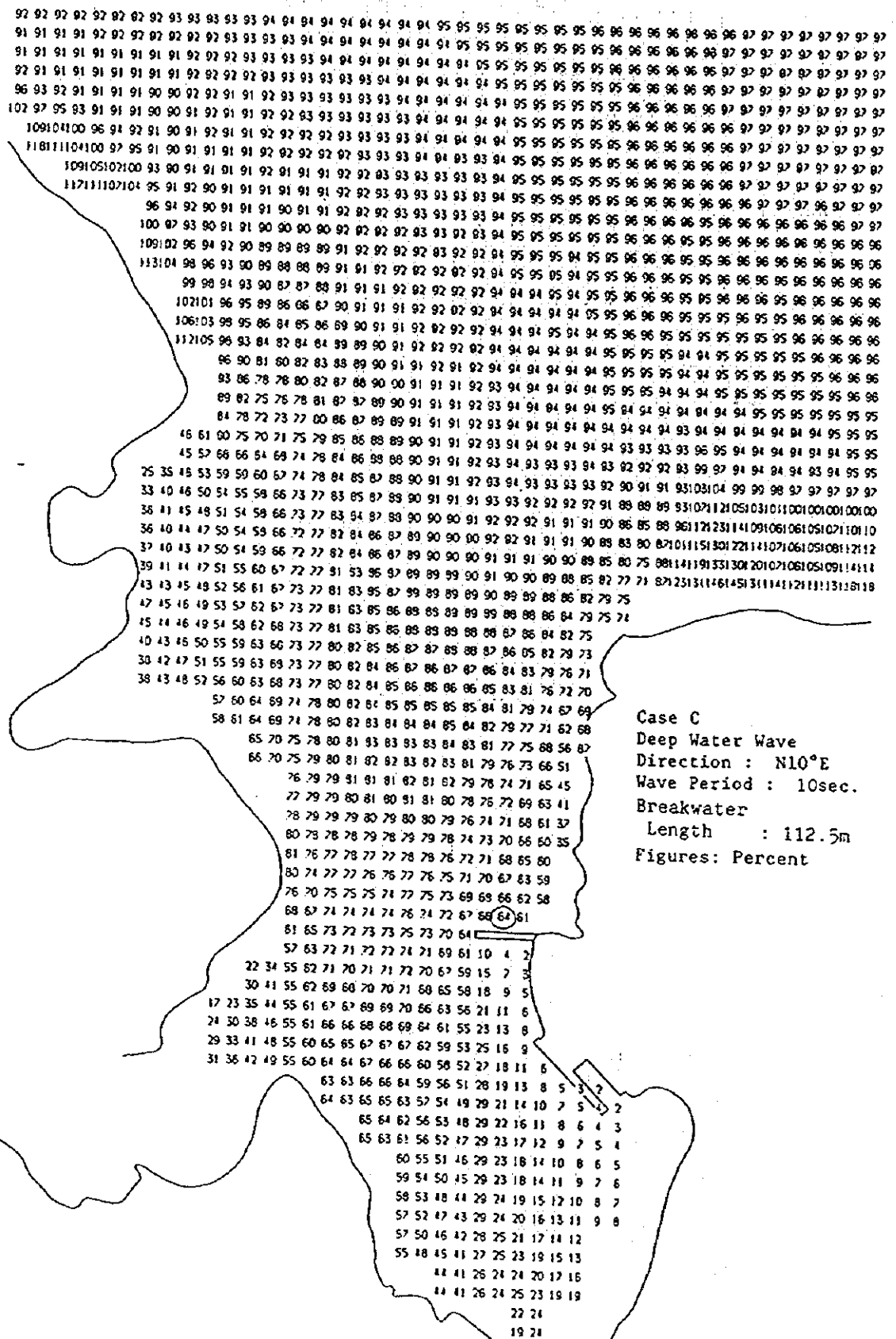
The limiting wave height is applied to be 50 cm in front of berthing area. The frequency of wave height is mentioned in the feasibility study 1987 as follows.

Wave Height 1 to 2m	32 days/year
2 to 3m	16 days /year
more than 3m	8 days/year

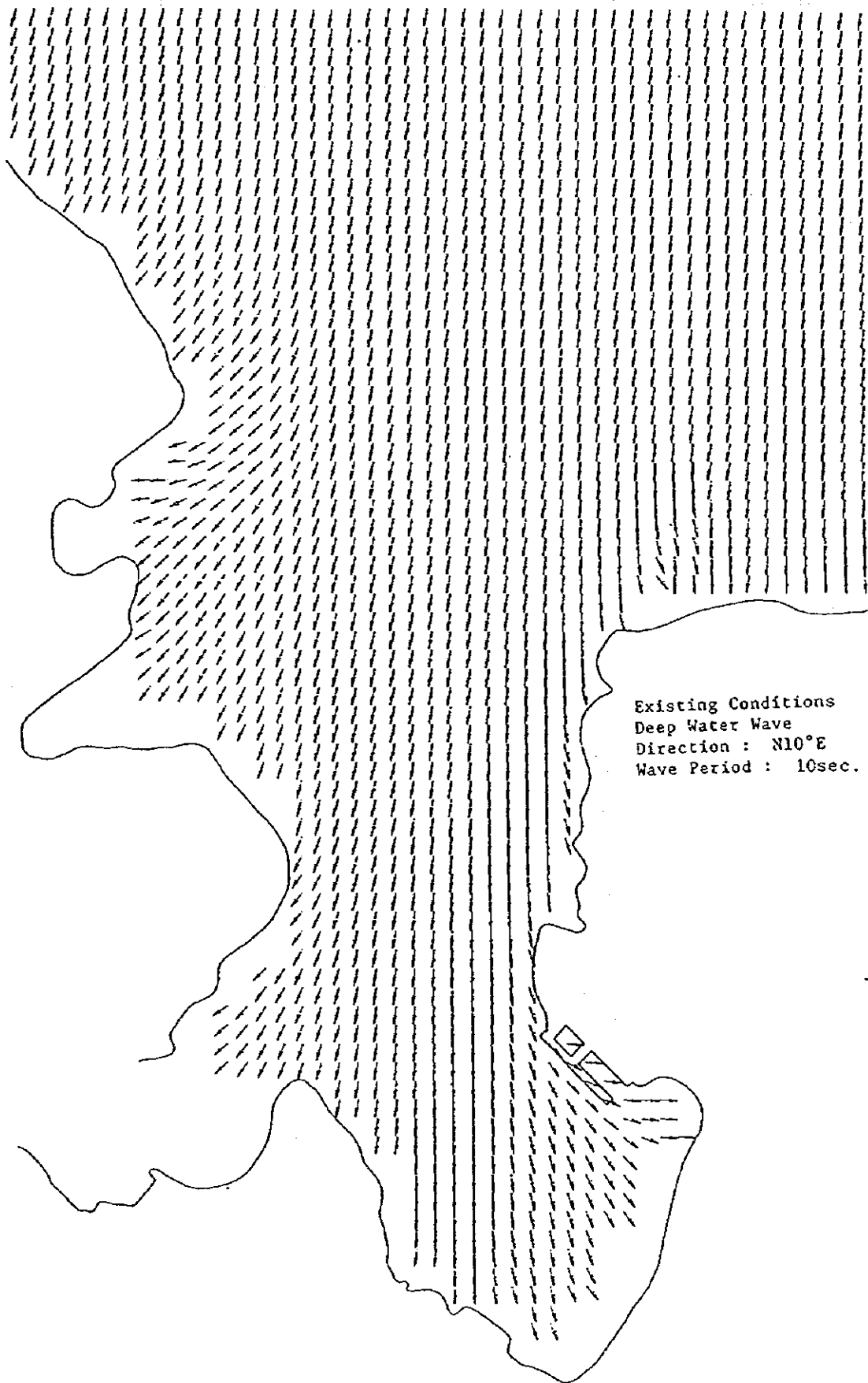
The results of calculation of working ratio of cargo handling are shown in App. Figure 10.4-3 and App. Table 10.4-2.

Table 10.4-2 Working Ratio of Cargo Handling of New Wharf

	Working Ratio of Handling (%)	Workable Days of Handling (days)
New wharf at present	93.4	341
New wharf after Improvement	95.0	347
Existing wharf at present	96.3	351



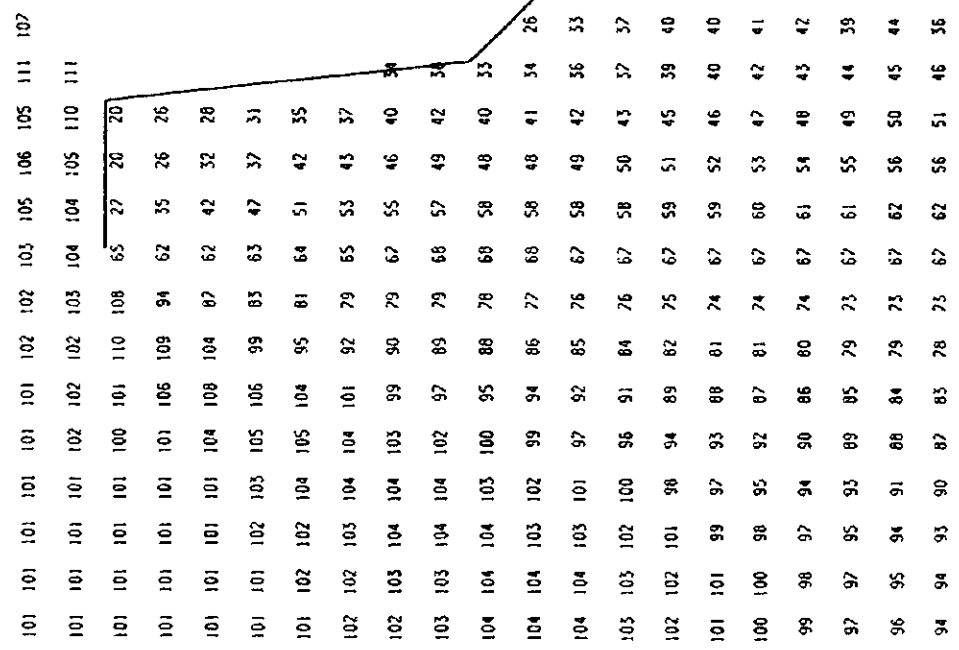
App. Figure 10.4-1(1) Wave Height Ratio in Offshore



App. Figure 10.4-1(2) Change of Wave Direction

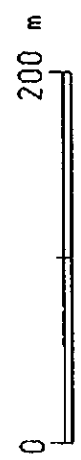
N

Incident Wave

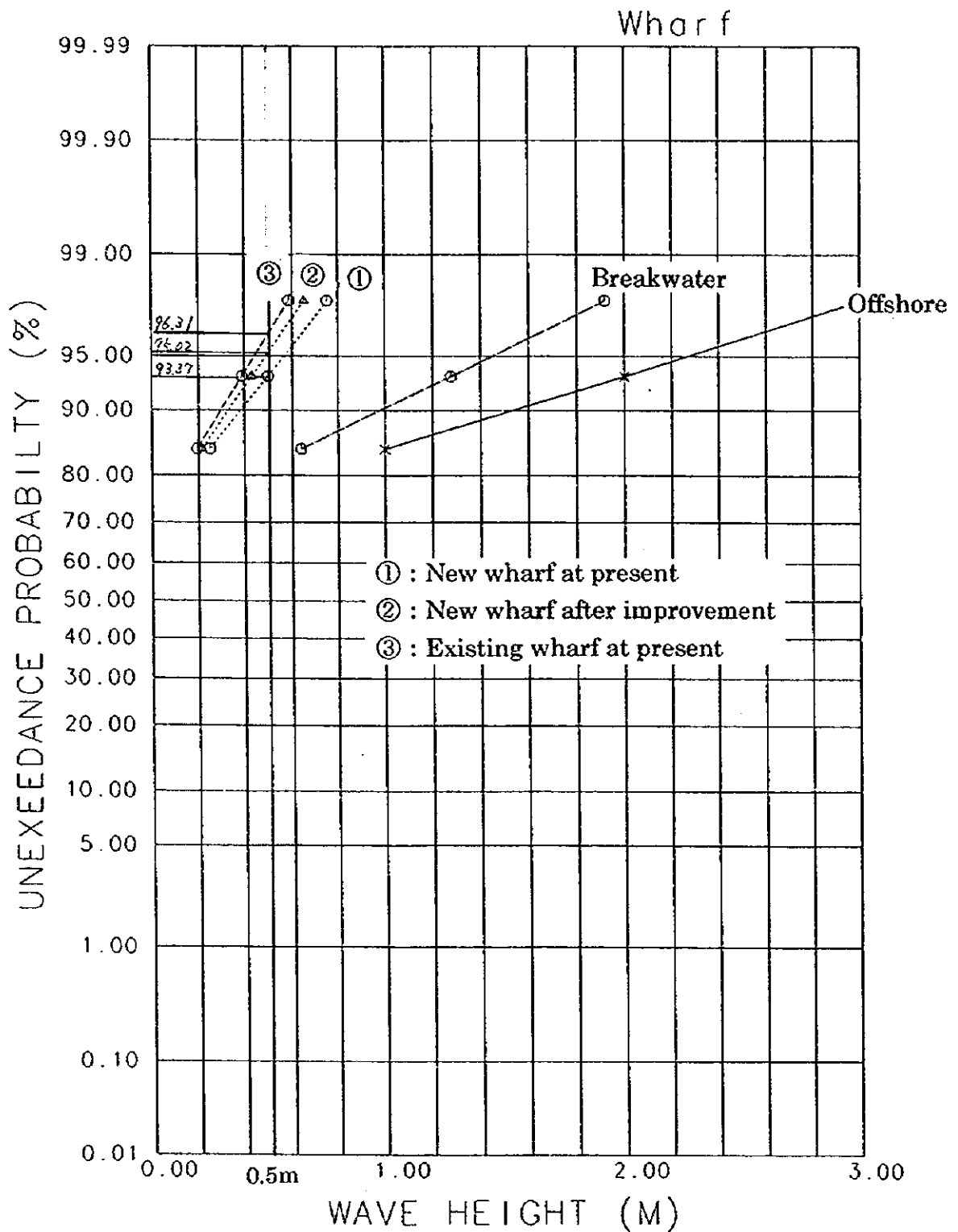


(Unit: m)

Wave Direction	N
Wave Period	10.0 sec



App. Figure 10.4-2(1) Wave Height Ratio in front of New Wharf
(Transmission Coefficient 0 %)



App. Figure 10.4-3 Working Ratio of Cargo Handling

Appendix 10.4 (1) Working Records of Tug Boats in 1997

month	day	Tafola		W.time		Pualele		W.time		Arrival Deppatur e	Name of Vessel	GRT	Bow Thruster	Tanker	Tafola	Pualele	
		S.time	E.time	S.time	E.time	S.time	E.time	S.time	E.time								
1	2					21			1	a	Forum Samoa	6861	○				
1	3	14				1				d	Forum Samoa	6861	○		☆		
1	4	5				2	5			a	Odense Maesk	28010		t	☆	☆	
1	4	12	13	1						2	Odense Maesk	28010		t	☆	☆	
1	4	17	18	1							Odense Maesk	28010		t	☆		
1	4	22	23	1							Odense Maesk	28010		t	☆		
1	5	2	3	1							Odense Maesk	28010		t	☆		
1	5	6	7	1							Odense Maesk	28010		t	☆		
1	6	5				2	5			2	a	Teign Bank	18663		☆	☆	
1	8	13	14	1							Teign Bank	18663			☆		
1	10	10	11	1						a	Southern Cross	3186	○		☆		
1	10	18	21	3						a	Fua Kavenga	6861	○		☆		
1	10	23	24	1						d	Fua Kavenga	6861	○		☆		
1	12	2	4	2						d	Fua Kavenga	6861	○		☆		
1	12	15				2	15			2	Teign Bank	18663			☆	☆	
1	15	5				1				d	Teign Bank	18663			☆		
1	15	8	9	1						a	Thor Rikke	1395	○		☆		
1	15	9	10	1						a	Thor Lisbeth	1395	○		☆		
1	15	14	15	1						d	Thor Rikke	1395	○		☆		
1	15	15.5	16.5	1						d	Thor Lisbeth	1395	○		☆		
1	16	5				1	7			2	Captain Martin	25060		t	☆	☆	
1	18	5				1				a	Moana Pacific	14023	○		☆		
1	18	14				1				d	Moana Pacific	14023	○		☆		
1	19					1				a	Polynesia	10774	○		☆		
1	20	6				1				a	Borac Gas	2602			☆		
1	22	16.5	17.5	1						d	Borac Gas	2602			☆		
1	23		1	1											☆		
1	23	13	14	1						a	Forum Samoa	6861	○		☆		
1	25	9				1				a	Southern Cross	3186	○		☆		
1	27	10.5	12	1.5							Sea Trial				☆		
1	27	13	15.5	2.5							Sea Trial				☆		
1	28	8.5	10.5	2											☆		
1	29	6				1				a	Crystal Symphony	51044	○		☆		
1	29	16.5				1				d	Crystal Symphony	51044	○		☆		
1	31	8.5	11.5	3							Sea Trial				☆		
2	7	20				1	20			1	a	Moray Bank	11956		☆	☆	
2	8	16				1				d	Moray Bank	11956			☆		
2	8	18				1				a	Thor Rikke	1395	○		☆		
2	8	19				1				a	Forum Samoa	6861	○		☆		
2	9	7				1				d	Thor Rikke	1395	○		☆		
2	11	8	9	1						a	Southern Cross	3186	○		☆		
2	11	9	10	1						a	Thor Lisbeth	1395	○		☆		
2	11	18	19	1						d	Southern Cross	3186	○		☆		
2	11	20	22	2		19				1	a	Fua Kavenga	6861	○		☆	☆
2	12	5	7	2						d	Thor Lisbeth	1395	○		☆		
2	12	7	8	1						d	Fua Kavenga	6861	○		☆		
2	17	5	8	3						a	Acoriano	1988			☆		
2	17	12	13	1						d	Acoriano	1988			☆		
2	17					15.5				1	a	Ariki Pacific	13998	○		☆	
2	17					16.5				1	Ariki Pacific	13998	○		☆		
2	18	10	11	1						a	Pacific Rover	1761		t	☆		
2	18									1	Ariki Pacific	13998	○		☆		
2	18									4	Ariki Pacific	13998	○		☆		
2	20	6	8	2							Polynesia	10774	○		☆		
2	22	16				1	16			1	a	Coral Islander	14294		☆	☆	
2	23	5				1				d	Coral Islander	14294			☆		
2	24	5				2	5			1	a	Foyle Bank	18641		☆	☆	
2	25	16.5				1				d	Foyle Bank	18641			☆		
2	26	14	15	1							Mangga Roa	290			☆		
2	26	19				1				a	southern Cross	3186	○		☆		
3	1	16	19	3						a	Thor Rikke	1395	○		☆		
3	1	21	23	2						d	Thor Rikke	1395	○		☆		
3	5	16	18	2		16.5				2	a	Pacific Islander	14146		☆	☆	
3	6	4	7	3		5				1	a	Pacific Islander	14146		☆	☆	

month	day	Tafola		W.time		Pualele		W.time		Arrival	Name of Vessel	GRT	Bow Thruster	Tanker	Tafola	Pualele
		S.time	E.time	S.time	E.time	S.time	E.time	S.time	E.time							
3	6					2										☆
3	7					1				a	Thor Lisbeth	1395	○			☆
3	7	4				1				a	Maunga Roa	290				☆
3	9	5				2	5		1	a	TSS Albatros	24803				☆
3	9	22				1				d	TSS Albatros	24803				☆
3	11	7				1	7		1	a	Borac Gas	2602				☆
3	12	16.5				1				d	Borac Gas	2602				☆
3	13	14	15	1						a	Fua Kavenga	6861	○			☆
3	14	5				1				a	Fua Kavenga	6861	○			☆
3	16	7				2	7		2	a	Odense Maersk	28010		t		☆
3	17	22								a	Southern Cross	3186	○			☆
3	18	5				1	5		1	d	Odense Maersk	28010		t		☆
3	19	5				1				a	Polynesia	10774	○			☆
3	19	12				1				d	Polynesia	10774	○			☆
3	20	10	12	2						a	Kyowa Cattleya	7945	○			☆
3	21					1			2	d	Kyowa Cattleya	7945	○			☆
3	21	7				1				a	Acoriano	1988				☆
3	21	16.5				1				d	Acoriano	1988				☆
3	22	6				1					Moana Pacific	14024				☆
3	23	12				1				a	Captain. Cnciano D	1348				☆
3	23	12				1				d	Captain. Cnciano D	1348				☆
3	24	10	11	1						a	Forum Samoa	6861	○			☆
3	24	11	12	1						a	Karin B	2649				☆
3	24	22				1				d	Forum Samoa	6861	○			☆
3	25	15.5	16.5	1						d	Karin B	2649				☆
3	26	14	15	1						a	Queen Amelia	1829				☆
3	27	16.5				1				d	Thor Lisbeth	1395	○			☆
4	6	15				1				a	Evelina da Rosa	1348				☆
4	7					1				d	Evelina da Rosa	1348				☆
4	10					1			1	a	Ariki Pacific	13998	○			☆
4	10	12				1				d	Ariki Pacific	13998	○			☆
4	10	20				1				a	Queen Amelia	1829				☆
4	11	10	11	1						a	Forum Samoa	6861	○			☆
4	11	20				1				d	Forum Samoa	6861	○			☆
4	14	6				2				a	Southern Cross	3186	○			☆
4	14	8	9	1						a	Fua Kavenga	6861	○			☆
4	14	16.5				1				d	Fua Kavenga	6861	○			☆
4	16	5				2	5		2	a	Captain Maartin	25060		t		☆
4	17					1				d	Captain Maartin	25060		t		☆
4	18	5				1				a	Polynesia	10774	○			☆
4	20	8				1				a	Acoriano	1988				☆
4	21	9	10	1						d	Acoriano	1988				☆
4	23	11	12	1						a	Maunga Roa	290				☆
4	23	16.5				1				a	Karin B	2649				☆
4	23	23				1				d	Karin B	2649				☆
4	28	5	8	3						a	Queen Amelia	1829				☆
4	28	18	20	2	16.5				1	a	Coral Islander	14294				☆
4	29	14	15	1						d	Coral Islander	14294				☆
4	29				16.5				1		Ivy Bank	11941				☆
5	1	16.5				1				d	Ivy Bank	11941				☆
5	1	9.5				1				a	Pacific Rover	1761		t		☆
5	2	16.5				1				a	Forum Samoa	6861	○			☆
5	3	8				1				d	Forum Samoa	6861	○			☆
5	6	6				1				a	Forum Tokelau	808				☆
5	10					1				a	Pacific Islander	14146				☆
5	11					1				d	Pacific Islander	14146				☆
5	13					1				a	Forum Tokelau	808				☆
5	13	16.5				1					Forum Tokelau	808				☆
5	13	18				1				a	Moana Pacific	14023				☆
5	14	5				1				d	Moana Pacific	14023				☆
5	14	7	8	1							Forum Tokelau	808				☆
5	14	9.5	10.5	1						a	Southern Cross	3186	○			☆
5	14	16.5	18	1.5						a	Queen Amelia	1829				☆
5	15	6	7	1						d	Queen Amelia	1829				☆

Month	Day	Tafola			W.time			Pualele			W.time	Arrival	Name of Vessel	GRT	Bow Thruster	Tanker	Tafola	Pualele
		S.time	E.time		S.time	E.time		S.time	E.time									
5	15	8	9	1								Forum Tokelau	808				☆	
5	16	21	24	3							a	Fua Kavenga	6861	○			☆	
5	21	7	8	1								Forum Tokelau	808				☆	
5	22	17	24	7							a	Kyowa Cattleya	7945	○			☆	
5	23	5	7	2							d	Kyowa Cattleya	7945	○			☆	
5	23	7	8	1							a	Forum Samoa	6861	○			☆	
5	23	20	22	2							a	Acoriano	1988				☆	
5	23	22	24	2							d	Forum Samoa	6861	○			☆	
5	24		8	8								Pacific Explorer	1149		t		☆	
5	25	21			1							Forum Tokelau	808				☆	
5	28	7	8	1							a	Karin B	2649				☆	
5	28	16.5	18	1.5							d	Karin B	2650				☆	
6	1	5	8	3													☆	
6	1	8	11	3							a	Anki Pacific	13998	○			☆	
6	2		2	2							d	Anki Pacific	13998	○			☆	
6	5	9	12	3							a	Pacific Rover	1761		t		☆	
6	5				16.5					2		Pacific Rover	1761		t		☆	
6	6	5	7	2							a	Southern Cross	3186	○			☆	
6	6	7	8	1							d	Pacific Rover	1761		t		☆	
6	6	16.5	19	2.5							d	Southern Cross	3186	○			☆	
6	6	21	24	3							a	Forum Tokelau	808				☆	
6	15				1						d	Forum Samoa	6861	○			☆	
6	15	6.5	8.5	2		5				2	a	Captain Martin	25060				☆ ☆	
6	16	7	8	1							d	Captain Martin	25060		t		☆	
6	17	13	14	1							d	Fua Kavenga	6861	○			☆	
6	17	14	15	1		15				1	a	Socofi Stream	4885				☆ ☆	
6	18	11.5	15	3.5							d	Socofi Stream	4885				☆	
6	18	16.5	22	5.5		16.5				1	a	Trans Pacific Nr.6	9028	○			☆ ☆	
6	18	21	22	1							d	Trans Pacific Nr.6	9028	○			☆	
6	19	16.5	18	1.5		16.5				2	a	Teignbank	18663				☆ ☆	
6	20	16	17	1							d	Teignbank	18663				☆	
6	21	13	22	9		13				1	a	Fcylebank	18641				☆ ☆	
6	21	20	22	2		16				2	d	Fcylebank	18641				☆ ☆	
6	22	23	24	1							a	Coral Islander	14294				☆	
6	23		2	2						2	a	Coral Islander	14294				☆ ☆	
6	23	9	10	1							d	Coral Islander	14294				☆	
6	24	9	10	1								Forum Tokelau	808				☆	
6	27	7	8	1							a	Acoriano	1988				☆	
6	27	15	16	1							d	Acoriano	1988				☆	
6	29	5	7	2							a	Southern Cross	3186	○			☆	
6	30	6	8	2							d	Southern Cross	3186	○			☆	
6	30	8	10	2		9				2	a	Pacific Explorer	1149		t		☆ ☆	
7	2	7	8	1							a	Te Kou Maru	348				☆	
7	2	13			1						d	Forum Tokelau	808				☆	
7	2	16.5	19	2.5							d	Pacific Explorer	1149		t		☆	
7	3		3	3							a	Thor Lisbeth	1395	○			☆	
7	3	7	8	1							d	Thor Lisbeth	1395	○			☆	
7	4	6	8	2							a	Forum Samoa	6861	○			☆	
7	4	7	8	1								Forum Tokelau	808				☆	
7	5	5	7	2							d	Forum Samoa	6861	○			☆	
7	8	12	14	2		12	14	2			a	Moana Pacific	14023	○			☆ ☆	
7	8	16.5	18	1.5							d	Moana Pacific	14023	○			☆	
7	8	20	24	4		21.5	23.5	2			a	Pacific Islander	14146				☆ ☆	
7	9	12	13	1							d	Pacific Islander	14146				☆	
7	12	18			1						a	Forum Tokelau	808				☆	
7	13	16	19	3													☆	
7	14	7	8	1							a	Polynesia	10774	○			☆	
7	14	13	14	1							d	Polynesia	10774	○			☆	
7	14	14	15	1								Forum Tokelau	808				☆	
7	14	15	16	1							a	Maunga Roa	290				☆	
7	15	6	7	1								Forum Tokelau	808				☆	
7	15	7	8	1							a	Socofi Stream	4885				☆	
7	15	8	9	1								Forum Tokelau	808				☆	
7	15	14	15	1								Forum Tokelau	808				☆	

month	day	Tafola		W.time		Pualele		W.time		Arrival	Name of Vessel	GRT	Bow Thruster	Tanker	Tafola	Pualele
		S.time	E.time			S.time	E.time									
7	17	16.5				1				a	Fua Kavenga	6861	○		☆	
7	17	18				1					Maunga Roa	290			☆	
7	17	21				1				a	Southern Cross	3186	○		☆	
7	18	6	7	1						d	Fua Kavenga	6861	○		☆	
7	18	7	8	1						d	Southern Cross	3186	○		☆	
7	18	8	9	1							Forum Tokelau	808			☆	
7	19	16	19	3						d	Forum Tokelau	808			☆	
7	21	6	8	2						a	Pacific Rover	1762		t	☆	
7	21	16.5	19	2.5						d	Pacific Rover	1762		t	☆	
7	23	23	24	1						a	Forum Samoa	6861	○		☆	
7	24		2	2						a	Forum Samoa	6861	○		☆	
7	24	2	3	1						a	Toyoufuji #8	18337	○		☆	
7	24	3	4	1							Forum Samoa	6861	○		☆	
7	24	16.5	18	1.5						a	Forum Tokelau	808			☆	
7	24	19	21	2						d	Forum Samoa	6861	○		☆	
7	24	21	24	3	20			2		d	Toyoufuji #8	18337	○		☆	☆
7	25	6	9	3	5			2		a	Captain Martin	25060		t	☆	☆
7	25	9	10	1						a	Kyowa Cattleya	7945	○		☆	
7	25	18	20	2						d	Kyowa Cattleya	7945	○		☆	
7	25	21	24	3	20			1		a	Aniki Pacific	13998	○		☆	☆
7	26							1		d	Captain Martin	25060		t		☆
7	26	5	7	2						d	Aniki Pacific	13998	○		☆	
7	27				2						Thor Lisbeth	1395	○		☆	
7	29	7	8	1						a	Capt. M J Souza	1171			☆	
7	29	8	9	1							Forum Tokelau	808			☆	
7	29	9	10	1						a	Stella Maris	1957			☆	
7	30	9	10	1						d	Stella Maris	1957			☆	
7	30	10	11	1						d	Capt. M J Souza	1171			☆	
7	30	11	12	1							Forum Tokelau	808			☆	
8	2	6	7	1						a	Acoriano	1988			☆	
8	2	12			2					d	Acoriano	1989			☆	
8	3	15	17	2						a	Pacific Explorer	1149		t	☆	
8	3				3										☆	
8	4	10	11	1						d	Pacific Explorer	1149		t	☆	
8	5	10	11	1						a	Southern Cross	3186	○		☆	
8	5	21	23	2						d	Southern Cross	3186	○		☆	
8	9	15	17	2						a	Karin B	2649			☆	
8	9	23	24	1						d	Karin B	2649			☆	
8	10		2	2						d	Karin B	2649			☆	
8	10	15	16	1							Forum Tokelau	808			☆	
8	12	10	12	2						a	Socoff Stream	4885			☆	
8	12	15	16	1							Forum Tokelau	808			☆	
8	12	16	17	1						d	Socoff Stream	4886			☆	
8	12	20	24	4						a	Polynesia	10774	○		☆	
8	13		5	5						d	Polynesia	10775	○		☆	
8	13	8	9	1							Forum Tokelau	808			☆	
8	13	23	24	1						a	Forum Samoa	6861	○		☆	
8	14		3	3						a	Forum Samoa	6861	○		☆	
8	14	6	8	2							Forum Tokelau	808			☆	
8	15	12	13	1						a	Arktis Ocean	1598			☆	
8	15	14	15	1						d	Arktis Ocean	1598			☆	
8	15	15	16	1	14			1		a	Tui Pacific	11998	○		☆	☆
8	15	19			2					d	Tui Pacific	11998	○		☆	
8	17	18			1					a	Fua Kavenga	6861	○		☆	
8	18	15	16	1						d	Fua Kavenga	6862	○		☆	
8	19	14	15	1						a	Forum Tokelau	808			☆	
8	19	16.5	18	1.5							Forum Tokelau	808			☆	
8	19	18	20	2				1		a	Coral Islander	14294			☆	☆
8	19	20	24	4						a	Pacific Rover	1762		t	☆	
8	20	5	7	2	5			1		d	Coral Islander	14294			☆	☆
8	20	7	8	1						a	Thor Lisbeth	1395	○		☆	
8	20				9			1			Arktis Ocean					☆
8	20	16.5	17	0.5						d	Thor Lisbeth	1395	○		☆	
8	20	17	18	1						a	Forum Tokelau	808			☆	

month	day	Tafola			Pualele			Arrival	Deppatur	Name of Vessel	GRT	Bow Thruster	Tanker	Tafola	Pualele
		S.time	E.time	W.time	S.time	E.time	W.time								
8	21	5	6	1					Forum Tokelau	808			☆		
8	21	6	8	2				a	FV Seaka	146			☆		
8	21	9	11	2				a	Aberdeen Star	229			☆		
8	22	10	11	1					Artis Ocean				☆		
8	22	11	12	1					Forum Tokelau	808			☆		
8	23	20	23	3				a	Southern Cross	3186	○		☆		
8	24	22	24	2				d	Southern Cross	3186	○		☆		
8	25		2	2				a	Kyowa Hibiscus	7945	○		☆		
8	25	6	8	2				d	Kyowa Hibiscus	7945	○		☆		
8	29	6	8	2	6	8	2	2	a	Pacific Gas	2602			☆	☆
8	29	16	17	1	16			1	d	Pacific Gas	2602			☆	☆
8	29	18			2	16.5		2	a	Captain Martin	25060		t	☆	☆
8	29				23	24	1			Captain Martin	25060		t	☆	☆
8	30	7			2	1	2	1		Captain Martin	25060		t	☆	☆
8	30				2	3	1			Captain Martin	25060		t	☆	☆
8	30				7			2	d	Captain Martin	25060		t	☆	☆
9	3	23	24	1					a	Forum Samoa	6861	○		☆	
9	4		2	2				2		Forum Samoa	6861	○		☆	☆
9	4	21	24	3					d	Forum Samoa	6861	○		☆	☆
9	6	6			2	6		1	a	Pacific Islander	14146			☆	☆
9	6	13			1				d	Pacific Islander	14146			☆	
9	7	5			1					Forum Tokelau	808			☆	
9	7	6			1	6		2	a	Ivy Bank	11941			☆	☆
9	10		1	1				1	d	Ivy Bank	11941			☆	☆
9	10	1	3	2	1			1	a	Southern Queen	2481			☆	☆
9	10	3	4	1					a	Southern Cross	3186	○		☆	
9	10	16.5			1					Forum Tokelau	808			☆	
9	10				1				d	Southern Queen	2481			☆	
9	11	15	16	1					a	Karin B	2649			☆	
9	11	16.5	20	3.5					a	Thor Lisbeth	1395	○		☆	
9	12	11	13	2	12			1	a	Polynesia	10774	○		☆	☆
9	12	16.5	20	3.5	18			1	d	Polynesia	10774	○		☆	☆
9	14	18	19	1	16			1	a	Ariki Pacific	13998	○		☆	☆
9	15	5	7	2					d	Ariki Pacific	13998	○		☆	☆
9	15	7	8	1					a	Forum Tokelau	808			☆	
9	16	5	8	3					d	Forum Tokelau	808			☆	
9	17	5	8	3	6	8	2	2	a	Olga Maersk	27997		t	☆	☆
9	18	6	7	1	6			1	d	Olga Maersk	27998		t	☆	☆
9	18	7	8	1					a	Fua Kavenga	6861	○		☆	
9	18	21	23	2					d	Fua Kavenga	6861	○		☆	
9	19	7	8	1					a	HMNZS Canterbury	2900			☆	
9	20	15			1	15		1	a	HMNZ Endeavour	1200			☆	☆
9	21	9			1				d	HMNZS Canterbury	2900			☆	
9	21	20			1				a	Forum Tokelau	808			☆	
9	25	4			1				a	Forum Samoa	6861	○		☆	
9	26	6			2	6		1	d	Pacific Mariner	1384		t	☆	☆
9	26	10	11	1					a	Southern Cross	3186	○		☆	
9	26	16.5	19	2.5					d	Southern Cross	3186	○		☆	
9	29	8	9	1						Forum Tokelau	808			☆	
10	2	16	17	1						Forum Tokelau	808			☆	
10	3	1	5	4	1			1	a	Kyowa Cattleya	7945	○		☆	☆
10	3	15	16	1					d	Kyowa Cattleya	7945	○		☆	
10	4	15	18	3					a	Tui Pacific	11998	○		☆	
10	4	15	16	1					d	Forum Tokelau	808			☆	
10	5	5	7	2					d	Tui Pacific	11998	○		☆	
10	5				7			1		Thor Lisbeth	1395	○			☆
10	6	5			5			1	d	Thor Lisbeth	1395	○			☆
10	7	14	15	1						Forum Tokelau	808			☆	
10	8		2	2					a	Southern Queen	2481			☆	
10	8	7	8	1					d	Southern Queen	2481			☆	
10	13		3	3					a	Polynesia	10774	○		☆	
10	13	5	9	4					d	Polynesia	10774	○		☆	
10	13	18	22	4					a	Southern Cross	3186	○		☆	
10	14	6	8	2					d	Southern Cross	3186	○		☆	

month	day	Tafola		W.time		Pualele		W.time		Arrival Doppatur a	Name of Vessel	GRT	Bow Thruster	Tanker	Tafola	Pualele
		S.time	E.time	S.time	E.time	S.time	E.time	S.time	E.time							
10	15	15	16	1						a	Forum Tokelau	808			☆	
10	16	11	12	1		11			1	a	Forum Samoa	6861	○		☆	☆
10	17		1	1						d	Forum Samoa	6861	○		☆	
10	17	5	6	1							Forum Tokelau	808			☆	
10	18	6	7	1						a	Forum Tokelau	808			☆	
10	18	7	8	1						a	Fua Kavenga	6861	○		☆	
10	18	11	14	3						a	Karin B	3649			☆	
10	18	20	21	1						d	Fua Kavenga	6861	○		☆	
10	20		3	3					2	a	Coral Islander	14294			☆	☆
10	20					11			1	d	Coral Islander	14294				☆
10	20					13	14	1			Forum Tokelau	808				☆
10	21	5	8	3		5			2	a	Captain Martin	25060		t	☆	☆
10	22	5	8	3						d	Captain Martin	25060		t	☆	
10	23	7	8	1							Forum Tokelau	808			☆	
10	24					4			2	a	Vaimama	10835				☆
10	24					10			1	d	Vaimama	10835				☆
10	26	5			1					a	Karin B	2649			☆	
10	28	11	12	1						a	Forum Tokelau	808			☆	
10	29	8	9	1							Forum Tokelau	808			☆	
10	29	9	10	1						a	Southern Cross	3186	○		☆	
10	29	16.5	17.5	1						d	Southern Cross	3186	○		☆	
10	29	17.5	24	6.5						a	Thor Lisbeth	1395	○		☆	
10	30	4	7	3						d	Thor Lisbeth	1395	○		☆	
10	30	7	8	1							Forum Tokelau	808			☆	
10	31	10	11	1							Forum Tokelau	808			☆	
10	31	11	12	1						a	Karin B	2649			☆	
10	31	12	13	1		12			1	a	Kyowa Hibiscus	7945	○		☆	☆
10	31	16.5	20	3.5						d	Kyowa Hibiscus	7945	○		☆	
11	1	12	14	2							Forum Tokelau	808			☆	
11	4	15	16	1							Forum Tokelau	808			☆	
11	5	1	4	3						a	Southern Queen	2481			☆	
11	5	12	13	1						d	Southern Queen	2481			☆	
11	7	14			1					d	Pacific Explorer	1149		t	☆	
11	8	5	6	1		5			1	a	Anki Pacific	13998	○		☆	☆
11	8				1					d	Anki Pacific	13998	○		☆	
11	8				1						Forum Tokelau	808			☆	
11	11	9	10	1							Forum Tokelau	808			☆	
11	11	10	11	1						a	Haumana	313.8			☆	
11	11	13	14	1							Forum Tokelau	808			☆	
11	14	7	8	1		7			2	a	Pacific Islander	14146			☆	☆
11	14	8	9	1							Forum Tokelau	808			☆	
11	15	5			1	5			1	a	Polynesia	10774	○		☆	☆
11	15	8			1					d	Polynesia	10774	○		☆	
11	15	11			1					a	Southern Cross	3186	○		☆	
11	15	13			1						Forum Tokelau	808			☆	
11	15	14			1					d	Southern Cross	3186	○		☆	
11	18				1					a	Fua Kavenga	6861	○		☆	
11	18	15	16	1						d	Fua Kavenga	6861	○		☆	
11	20	16.5	20	3.5							Haumana	313.8			☆	
11	21	5	8	3						a	Pacific Rover	1762		t	☆	
11	26								2	a	Tui Pacific	11998	○			☆
11	26								2		Tui Pacific	11998	○			☆
11	26					11.5			1	d	Tui Pacific	11998	○			☆
11	26					12			1	a	Maunga Roa	290			☆	
11	27					11			1	a	Forum Samoa	6861	○		☆	
11	27					20			1	a	Forum Tokelau	808			☆	
11	28								1	d	Forum Samoa	6861	○		☆	
11	28					20			2	d	Forum Tokelau	808			☆	
11	29					3			1	d	Vaimama	10835			☆	
11	29					7			1		Forum Tokelau	808			☆	
12	1					10			1	a	Southern Queen	2481				☆
12	2	21	22	1						a	Southern Cross	3186	○		☆	
12	3	6	7	1						d	Southern Cross	3186	○		☆	
12	10	6	8	2						a	Pacific Explorer	1149		t	☆	

month	day	Tafola		W.time	Pualele		W.time	Arrival Deppatur e	Name of Vessel	GRT	Bow Thruster	Tanker	Tafola	Pualele	
		S.time	E.time		S.time	E.time									
12	11	9	10	1	10			1	d	Pacific Explorer	1149		t	☆	☆
12	11	18	20	2					a	Thor Lisbeth	1395	○		☆	
12	12	6	8	2					a	Thor Lisbeth	1395	○		☆	
12	12	22	24	2					a	Kyowa Cattleya	7945	○		☆	
12	17	3			2				a	Polynesia	10774	○		☆	
12	18	12			1				a	Fua Kavenga	6861	○		☆	
12	18	16.5			1	16.5		1	a	Forum Tokelau	808			☆	☆
12	18	21			1	21		1	a	Lynx	1395			☆	☆
12	19	13	14	1					a	Forum Samoa	6861	○		☆	
12	19	14	15	1					d	Lynx	1395			☆	
12	19	16.5			1				d	Fua Kavenga	6861	○		☆	
12	19	20			1				a	Southern Cross	3186	○		☆	
12	20	5			2	5		2	a	Captain Martin	25060		t	☆	☆
12	20	8			1				d	Southern Cross	3186	○		☆	
12	20	10			1				d	Forum Samoa	6861	○		☆	
12	20	13			2	13		2	a	Coral Islander	14294			☆	☆
12	20	15			1				d	Coral Islander	14294			☆	
12	20	21			2	21		2	a	Ariki Pacific	13998	○		☆	☆
12	21	5			1				d	Captain Martin	25060		t	☆	
12	21	7			1				d	Ariki Pacific	13998	○		☆	
12	27	18	20	2					a	Forum Tokelau	808			☆	

Appendix 11 Table 11-1 Construction Cost, Maintenance Cost and Residual Value in 2032 of Master Plan

Facility	Useful Life	Year 2001			Year 2002			Economic Price			Residual Value in 2032
		(Market Price)		Economic Price	Foreign Portion	Sub Total	Economic Price	Total Construction Cost	Maintenance Cost		
		Construction Cost	Foreign Portion							Local Portion	
Existing Wharf of without case	18	2,858	2,715	143	2,845	0	0	2,858	14	286	
New Wharf	30	30,822	24,698	4,148	28,431	495	1,486	30,265	91	3,027	
Breakwater	50	1,511	0	0	0	907	604	1,451	0	667	
Container Yard	30	1,307	0	0	0	392	915	1,217	0	122	
SPA Office	30	1,553	33	131	151	417	972	1,279	0	143	
Tug Boat	15	7,063	0	0	0	7,063	0	7,063	0	706	
Ferry Wharf	35	409	0	0	0	245	164	393	0	90	
Engineering Service	30	4,086	2,206	245	2,429	1,471	164	4,049	0	405	
Total of Plan 1 in 2001 and 2002		46,751	26,932	4,524	31,011	10,990	4,305	45,868	91	5,160	

Facility	Useful Life	Year 2013			Year 2014			Economic Price			Residual Value in 2032
		(Market Price)		Economic Price	Market Price		Economic Price	Total Construction Cost	Maintenance Cost		
		Construction Cost	Foreign Portion		Local Portion	Foreign Portion				Local Portion	
Dredging	40	10,500	8,400	2,100	10,311			10,311	280	5,903	
Small Boat Jetty	30	70	60	10	69			69	0	30	
Relocation of Mooring Buoy for Tanker	30	440	374	66	434			434	1	187	
Container Yard	30	8,143	1,221	2,850	3,815	1,222	2,850	7,630	23	3,395	
Renovation of Existing Gate	15	220				44	176	204	1	20	
Marina	30	4,200	630	1,470	1,968	620	1,470	3,935	12	1,751	
Green Area	30	720				144	576	668	2	307	
CFS	20	5,100				1,530	3,570	4,779	22	908	
Shed	20	3,450				1,035	2,415	3,233	15	614	
Maintenance Shop	20	560				168	392	525	2	100	
Coconut Oil Tank	30	810	324	486	766			766	2	329	
Engineering Service	30	3,090	997	628	1,568	435	1,030	2,941	0	1,306	
Total of Plan 1 in 2013 and 2014		37,303	12,006	7,610	18,931	5,208	12,479	35,495	360	14,851	

Appendix 11 Table 11-2 EIRR(Economic Internal Rate of Return)

Calculation of Master Plan

(unit : 1000 Tala)

EIRR = 10.82%

Year	Constructi	Maintenan	Operation	(A)	Savings in	Savings in	(B)	(B) - (A)
	Cost	Cost	Cost	Total	ship staying	cargo handling	Total	
				Cost	Costs	Costs	Benefit	
2001	31,011			31,011	0	0	0	-31,011
2002	14,857			14,857	999	786	1,785	-13,072
2003		91	7	98	2,109	1,641	3,750	3,652
2004		91	8	99	2,346	1,706	4,052	3,953
2005		91	8	99	2,582	1,770	4,352	4,254
2006		91	8	99	2,850	1,837	4,687	4,588
2007		91	8	99	3,117	1,904	5,021	4,922
2008		91	9	100	3,426	1,974	5,400	5,300
2009		91	9	100	3,734	2,043	5,777	5,677
2010		91	9	100	4,276	2,123	6,399	6,299
2011		91	10	101	4,818	2,203	7,021	6,920
2012		91	10	101	5,441	2,279	7,720	7,619
2013	18,931	91	10	19,032	6,063	2,354	8,417	-10,615
2014	16,564	91	11	16,666	6,998	2,432	9,430	-7,235
2015		451	11	462	7,933	2,510	10,443	9,982
2016		451	11	462	7,933	2,510	10,443	9,982
2017		451	11	462	7,933	2,510	10,443	9,982
2018		451	11	462	7,933	2,510	10,443	9,982
2019		451	11	462	7,933	2,510	10,443	9,982
2020		451	11	462	7,933	2,510	10,443	9,982
2021		451	11	462	7,933	2,510	10,443	9,982
2022		451	11	462	7,933	2,510	10,443	9,982
2023		451	11	462	7,933	2,510	10,443	9,982
2024		451	11	462	7,933	2,510	10,443	9,982
2025		451	11	462	7,933	2,510	10,443	9,982
2026		451	11	462	7,933	2,510	10,443	9,982
2027		451	11	462	7,933	2,510	10,443	9,982
2028		451	11	462	7,933	2,510	10,443	9,982
2029		451	11	462	7,933	2,510	10,443	9,982
2030		451	11	462	7,933	2,510	10,443	9,982
2031		451	11	462	7,933	2,510	10,443	9,982
2032		451	11	462	7,933	2,510	10,443	9,982
Residual Value				-20,011				20,011
								10.82%

Appendix Table A 11-3 Calculation of Port Revenue

- 1) Pilotage = $0.1 \text{ Tala/GRT} \times \text{Number of Vessels} \times \text{Using Pilot} \times \text{Average GRT of Vessels}$
- 2) Light Dues = $40 \text{ Tala/vessel} \times \text{Number of Vessels}$
- 3) Port Dues
 - (3-1) Port Dues of Sea-going Vessels = $0.05 \text{ Tala/GRT} \times \text{Number of Vessels} \times \text{Average GRT of Vessels}$
 - (3-2) Port Dues of Home-trade Vessels = $5 \text{ Tala/GRT} \times \text{Total GRT of Home-trade Vessels}$
- 4) Cargo Dues = $0.1 \text{ Tala/ton} \times \text{Total Cargo Volume}$
- 5) Wharfage
 - (5-1) Wharfage of Import Cargo other than Bulk Petroleum = $2.0 \text{ Tala/ton} \times \text{Import General Cargo Volume}$
 - (5-2) Wharfage of Export Cargo = $1.5 \text{ Tala/ton} \times \text{Export Cargo Volume}$
 - (5-3) Wharfage of Import Bulk Petroleum = $1.0 \text{ Tala/ton} \times \text{Import Bulk Petroleum Volume}$
- 6) Storage Fees of loose Cargoes = $4.25 \text{ Tala/ton} \times \text{Stored loose Cargo Volume}$ (note : Average dwell time is 7 ~ 8 days.)
- 7) Storage Fees of Containers = 0.03 Tala/ton (actual data per Container Cargo Volume in 1997) \times Container Cargo Volume
- 8) Berthage
 - (8-1) Up to 1,500 GRT = $40 \text{ Tala/vessel} \times \text{Number of Vessels} \times 0.3$
 - (8-2) In Excess of 1,500 GRT = $60 \text{ Tala/vessel} \times \text{Number of Vessels} \times 0.7$
note : 30% of vessels in 1997 is up to 1,500 GRT as shown in Table 7.2.2-5.
- 9) Dockage = $0.05 \text{ Tala/GRT} \times 5,800 \text{ GRT/vessel} \times \text{Number of Vessels using Berths}$
Note : Average GRT of vessels is 5,800 GRT as shown in Table 7.2.2-5.
- 10) Fee for Shed Use = $1 \text{ Tala/foot}^2 \times \text{Area of Shed Use}$
- 11) Miscellaneous
 - (11-1) Wharf Cleaning = $\text{Number of Vessels} \times (0.1 \times 100 + 0.9 \times 50) \text{ Tala/vessel}$
 - i) tallow, cement or bitumen or like commodities = $\text{Number of Vessels} \times 0.1 \times 100 \text{ Tala/vessel}$
 - ii) other commodities = $\text{Number of Vessels} \times 0.9 \times 50 \text{ Tala/vessel}$
 - (11-2) Tug Service
1,079 Tala/vessels \times Number of Vessels
Note : Actual data in 1997
 - (11-3) Staff overtime
1,257 Tala/vessel \times Number of Vessels
 - (11-4) Fresh Water Supply
93 Tala/vessel \times Number of Vessels
Note : Budget data in 1997
 - (11-5) Electricity etc.
102,100 Tala (Note : Budget data in 1997)
 - (11-6) Domestic Port Charge = Number of Passenger of Domestic Ferry $\times (6\text{Tala} \times 81\% + 3\text{Tala} \times 19\%) \times 10\%$

Appendix Table A.11-4 Fundamental Conditions of Port Revenue

Year	1996	1997	1998	1999	2000	2001	2003	2005	2007	2009	2011	2013	2015
Forecast Population(1,000)	164.6	165.0	165.5	166.0	166.4	166.9	167.7	168.6	169.4	170.2	170.9	171.7	172.4
Forecast GDP (million WSS)	157.0	160.1	163.3	166.6	169.9	173.3	180.0	186.2	192.6	199.2	206.0	213.1	220.4
(A) Total General Cargo	193,373	214,786	218,808	230,537	242,500	254,702	278,771	300,935	323,858	347,568	372,091	397,454	423,658
Import General Cargo Volume	171,317	187,490	191,044	201,851	212,702	223,401	243,742	261,902	281,342	301,416	321,797	344,773	368,147
Export General Cargo Volume	22,056	27,296	27,764	28,686	29,798	31,301	35,029	39,033	42,516	46,152	50,294	52,681	55,541
Export Coconut Oil Cargo Volume	6,489	4,315	5,273	6,443	7,873	9,620	9,889	10,451	11,044	11,672	12,334	13,035	13,775
Export Cargo Volume	28,545	31,611	33,037	35,129	37,671	40,921	44,918	49,484	53,560	57,824	62,628	65,716	69,316
Import Bulk Petroleum Volume	35,313	39,530	41,398	42,505	43,653	44,843	47,353	49,327	51,384	53,527	55,759	58,084	60,507
Total Cargo Volume (tons)	235,175	258,631	265,479	279,485	294,026	309,165	336,013	360,713	386,287	412,767	440,184	468,573	497,970
Stored loose Cargo Volume	54,203	60,248	66,516	60,101	63,512	66,733	71,466	77,355	84,103	90,467	96,388	101,805	106,649
Container Cargo Volume	163,730	181,810	190,933	200,513	210,574	221,139	243,888	263,035	282,055	302,472	324,356	347,822	372,967
Container Ship	142	147	151	156	161	166	175	184	192	201	210	218	227
General Cargo Ship	17	17	18	18	18	18	19	20	21	22	22	23	24
Cruise Ship	13	13	14	14	15	15	16	17	18	19	19	20	21
Others	17	18	18	19	19	20	21	22	23	24	25	26	27
Number of Vessels	189	195	201	207	213	219	231	242	254	265	276	288	299
Tanker	21	22	22	23	24	25	26	27	29	30	31	33	34
Naval Boat	3	3	3	3	4	4	4	4	4	5	5	5	5
Number of Vessels Calling Apia Port	213	220	227	234	240	247	261	274	287	300	312	325	338
Ratio of Pilot Use (%)	92	92	92	92	92	92	92	92	92	92	92	92	92
Average GRT of Vessels Using Pilots	7,460	7,460	7,460	7,460	7,460	7,460	7,460	7,460	7,460	7,460	7,460	7,460	7,460
Average GRT of Vessels	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
Total GRT of Home-trade Vessels	989	989	989	989	1,857	1,857	1,857	1,857	1,857	1,857	1,857	1,857	1,857
Shed Area Used (foot)	46,970	46,970	46,970	46,970	46,970	46,970	46,970	46,970	46,970	46,970	46,970	46,970	46,970
Import Bulk Petroleum, Asau Port(tons)	3,459	3,527	3,652	3,782	3,916	4,056	4,349	4,670	5,021	5,398	5,803	6,239	6,708
Average GRT of Vessels	1,497	1,365	1,365	1,365	1,365	1,365	1,365	1,365	1,365	1,365	1,365	1,365	1,365
Number of Vessels Calling Asau Port	6	5	5	5	6	6	6	7	7	8	8	9	10
Number of Passengers to Pagopago from Apia	10,943	10,460	10,490	10,519	10,547	10,575	10,630	10,683	10,735	10,785	10,834	10,881	10,928
Number of Passengers to Apia from Pagopago	8,801	8,646	8,850	9,059	9,273	9,492	9,945	10,420	10,917	11,439	11,985	12,557	13,157
Number of Total Passengers of Ferry in Apia Port	19,744	19,106	19,340	19,577	19,820	20,067	20,575	21,103	21,652	22,224	22,819	23,439	24,085
Number of Ferries Calling Apia Port include charter	69	62	62	62	63	63	63	63	64	64	64	64	65
Number of Domestic Ferry Passengers(max : 220)	419,873	434,161	448,935	464,212	465,471	466,709	469,126	471,470	473,746	475,961	478,118	480,221	482,275
Number of Ferries, Mulifanua - Salolologa Port	2,086	2,086	2,086	2,110	2,116	2,121	2,132	2,143	2,153	2,163	2,173	2,183	2,192

JICA